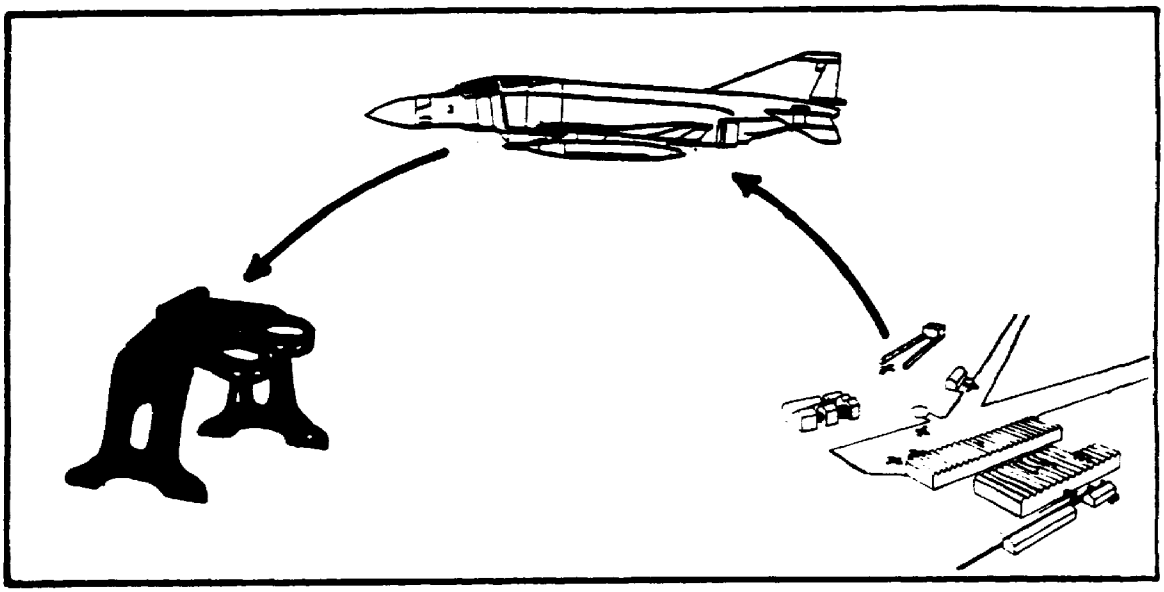
SUBCOURSE
IT0674

EDITION
A

US ARMY INTELLIGENCE CENTER

ANALYZE FABRICATION INDUSTRIES ON AERIAL IMAGERY



THE ARMY INSTITUTE FOR PROFESSIONAL DEVELOPMENT
ARMY CORRESPONDENCE COURSE PROGRAM

AIPD

READINESS/ PROFESSIONALISM
THRU GROWTH

ANALYZE FABRICATION INDUSTRIES ON AERIAL IMAGERY

Subcourse Number IT0674

EDITION A

U.S. Army Intelligence Center and School
Fort Huachuca, Arizona 85613-7000

3 Credit Hours

Edition Date: September 1991

SUBCOURSE OVERVIEW

This subcourse is designed to teach you basic procedures involved with analyzing fabrication industries on aerial imagery. Contained within this subcourse is instruction on how to analyze fabrication industries on aerial imagery.

There are no prerequisites for this subcourse.

This subcourse reflects the doctrine which was current at the time the subcourse was prepared.

TASK: You will identify procedures for analyzing fabrication industries on aerial imagery.

CONDITION: You will have access to extracts from FM 30-10, STP 34-96D24-SM-TG, TM 30-260.

STANDARD: You will analyze fabrication industries in accordance with FM 30-10, STP 34-96D24-SM-TG, TM 30-260.

NOTE: Replace the following pages with attached glossy photo pages for better viewing: 6, 21-24, 28-30, 39, 40, 42-47, 49, 50, 56-62.

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LESSON

ANALYZE FABRICATION INDUSTRIES ON AERIAL IMAGERY

MOS Manual Tasks: 301-338-2804
301-338-3701

OVERVIEW

TASK DESCRIPTION:

In this lesson, you will learn now to analyze fabrication industries on aerial imagery.

LEARNING OBJECTIVE:

ACTIONS:	Describe the information and procedures required to analyze fabrication industries on aerial imagery.
CONDITION:	You will be given access to extracts from FM 30-10, STP34-96D24-SM-TG. and TM 30-260.
STANDARDS:	Analyzing fabrication industries on aerial imagery will be in accordance with FM 30-10, STP 34-96D24-SM-TG. and TM 30-260.
REFERENCES:	The material contained in this lesson was derived from the following Publications: FM 30-10 STP 34-96D24-SM-TG TM 30-260.

INTRODUCTION

Fabrication industries use the products of processing industries to form and assemble the finished products. The majority of industrial establishments fail in the fabrication category. The fabrication industries are characterized by the buildings which shelter the equipment and materials used in fabrication and assemble. the lack of handling and storage facilities for bulk materials, the lack of outdoor equipment other than cranes, and little visible waste.

PART A: IDENTIFYING FABRICATION INDUSTRIES IN GENERAL

1. Fabrication industries characteristically shelter their raw materials, equipment, and finished products in buildings. As a result, relatively few of these industries can be identified from their photo images alone. Some fabrication industries can be identified only when the raw materials and end products are seen entering or leaving the plant. However, some use distinctive buildings or equipment, and others have raw materials and end products so bulky and impervious to the weather. The raw materials can be in open storage yards, and assembly of the end products can be performed out-of-doors.

2. Image components are an important part of an industrial facility. You must be able to identify images of objects and features comprising the components of the industry in order to identify specific operations or fabrication industry.

a. The most obvious and abundant image components are buildings. Buildings appear as either large or small, simple or complex structures.

b. The fabrication industries can be subdivided on the basis of the image components relating to buildings and storage yards into two subcategories: heavy fabrication and light fabrication.

NOTE: Electrical power industries (ACCP Subcourse IT 0675) are associated with fabrication industries. They provide the electricity needed for the production of end products. This is done through power lines, underground cable, or collocated generators.

3. The industry input materials key (Figure 1-1) indicates that input materials will appear as large or variable quantities, or none obvious. This does not lead you directly to fabrication industries. Continue down the key to "structure;" you see those structures associated with fabrication include large not complex buildings, and small buildings.

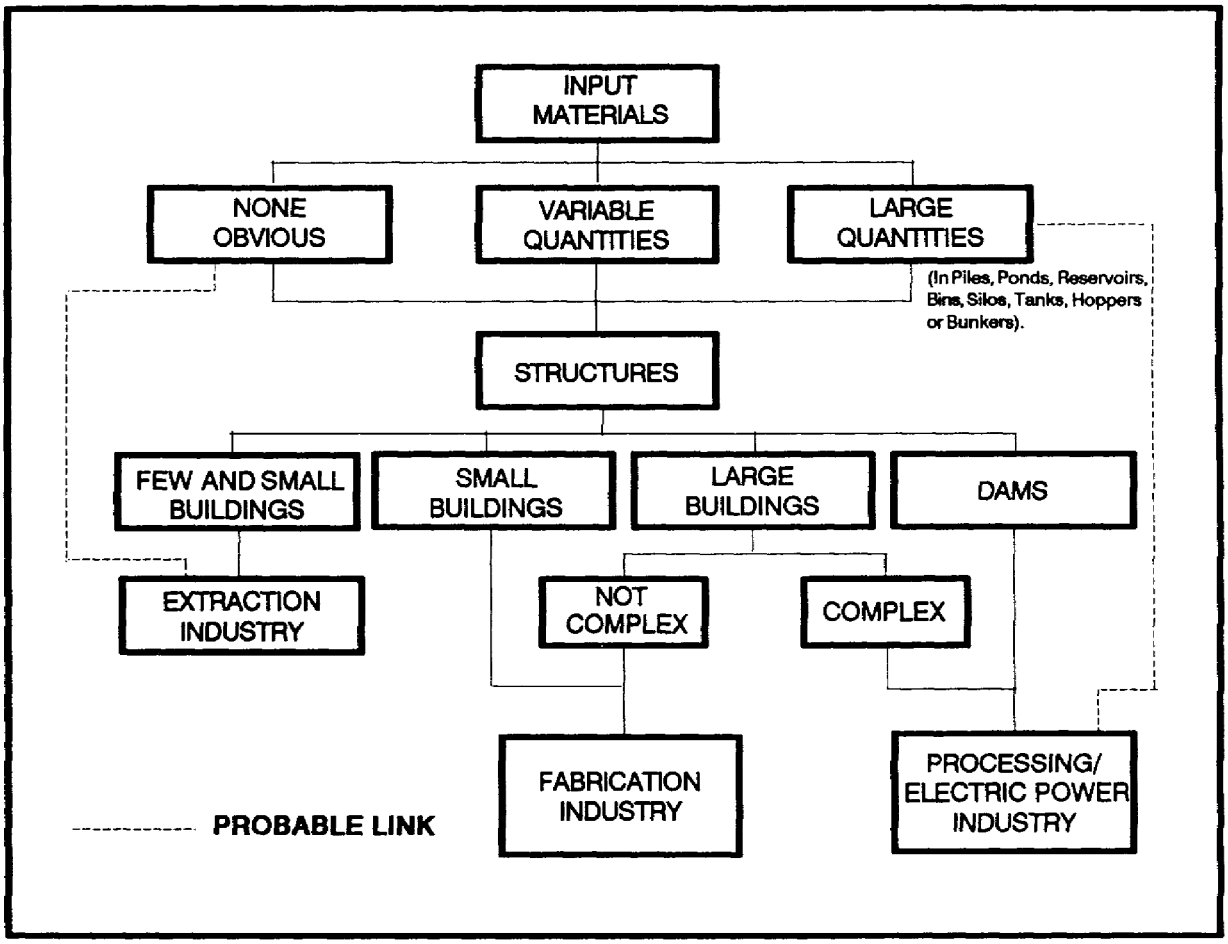


Figure 1-1. Industry input Materials Key.

4. In the industry outdoor equipment key (Figure 1-2) you will find the outdoor equipment associated with fabrication industries. Outdoor equipment includes a small amount other than lifting equipment. Continue down the key to Buildings. You see there are heavy, steel-frame, one-story buildings leading to heavy fabrication industry, and light, steel- or wood-frame multistory buildings leading to Light Fabrication industry.

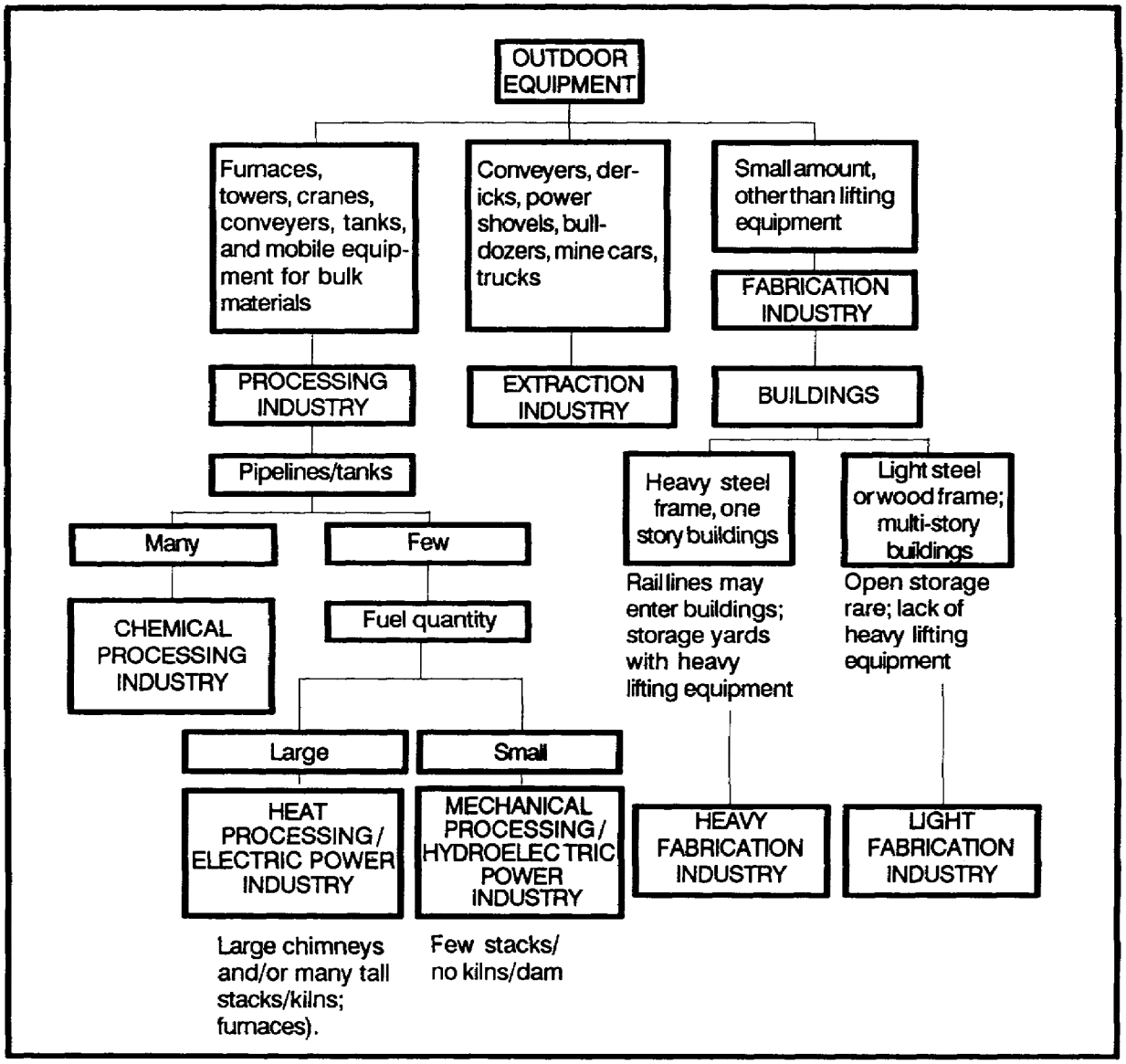


Figure 1-2. Industry Outdoor Equipment Key.

PART B: ANALYZING FABRICATION INDUSTRIES

1. Fabrication industries are those which utilize the products of processing industries to form and assemble finished products. General recognition features which can be used in analyzing fabrication industries include:

- o Rarely facilities for storing or handling bulk materials
- o Little outdoor equipment other than cranes
- o Large or small buildings.

2. Several transportation and construction features are common throughout fabrication industries. To analyze a specific industry you must be able to recognize these features. These features are broken down into five categories including: transportation, water coolers, buildings and roof types, cranes, and storage tanks.

a. Transportation. Both heavy and light fabrication industries use rail or highway transportation. The main difference between the two industries is the type of railcar or highway vehicle used.

(1) Heavy fabrication plants use railway flatcars (Figure 1-3), flatbed trailers, and special purpose trailers, such as vehicle transporters.

(2) Light fabrication plants use railway boxcars (Figure 1-4) or highway trucks (vans) for shipping their finished (end) products.

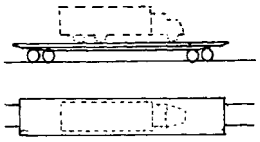


Figure 1-3. Flatcar
(For Heavy Fabrication
industry Transportation.

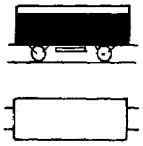


Figure 1-4. Boxcar
(For Light Fabrication
industry Transportation.)

(3) Figure 1-5 compares the boxcars (Annotation D) and the flatcar (Annotation E) on an image. Notice chat the boxcar is much shorter than the flatcar.

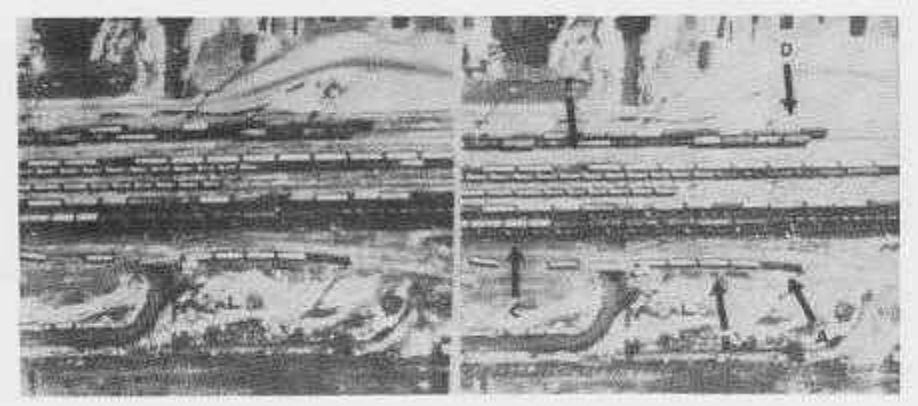


Figure 1-5. Railcars.

NOTE: Also observed in Figure 1-5 is a switch engine (Annotation A), gondola car (Annotation B), and a hopper car (Annotation C).

b. Water coolers can be found on roof tops or adjacent to heavy and light fabrication industry buildings (Figure 1-6).

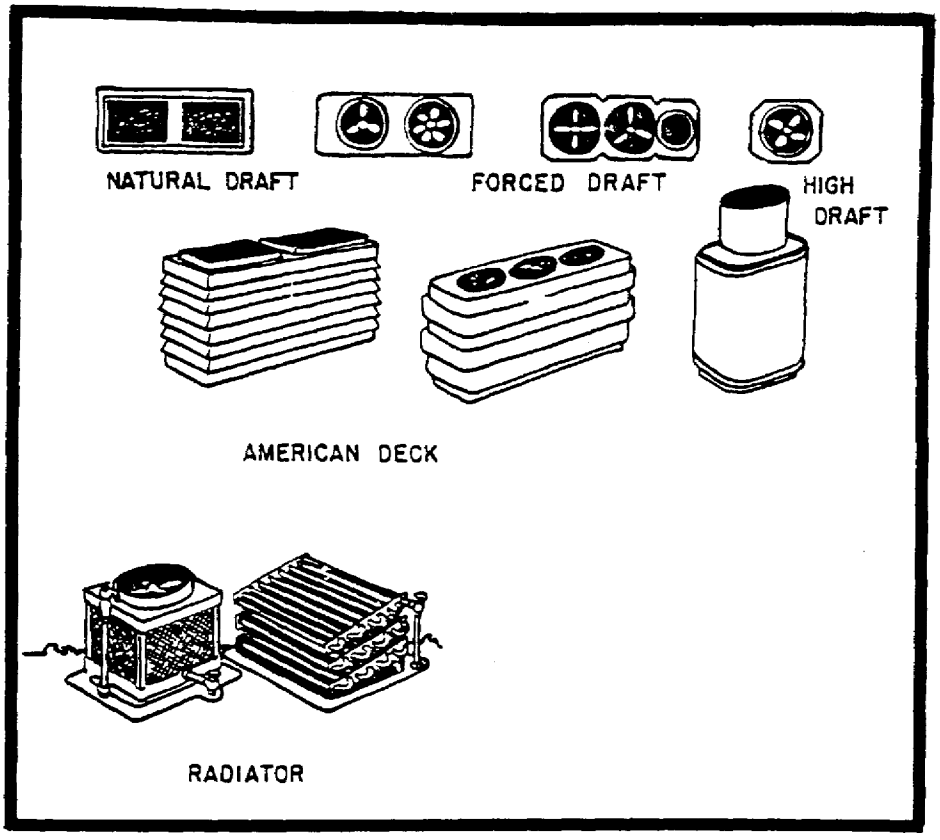


Figure 1-6. Water Coolers.

c. Building types are not always a definite clue for classifying a fabrication plant. This is especially true of older plants, because they may have converted from light to heavy fabrication or vice versa.

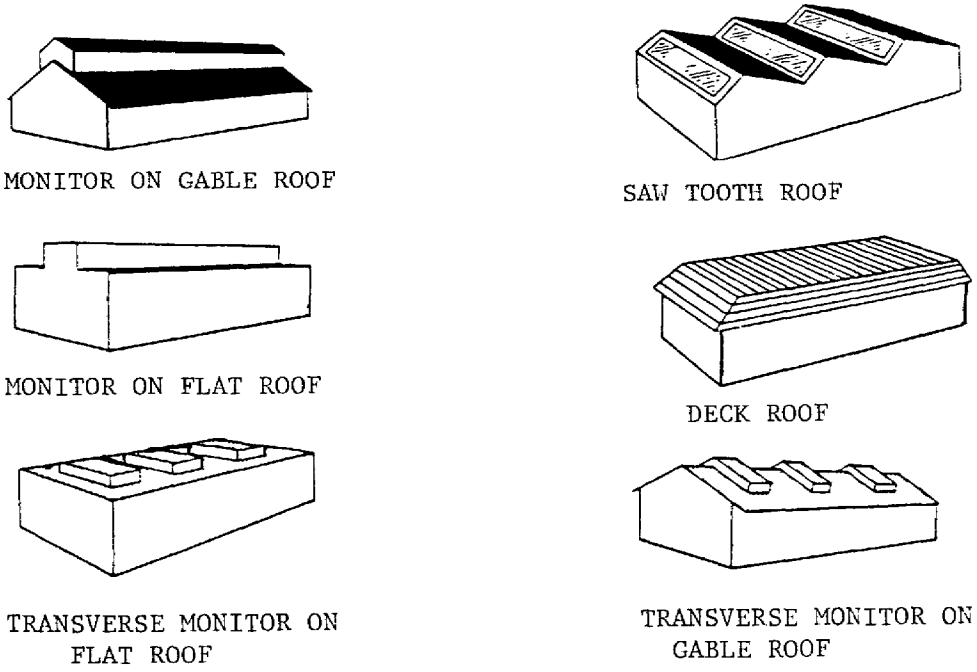
(1) The following building types are normally used in heavy fabrication plants:

- Single-story, heavy-steel frame
- Multistory, heavy-steel frame
- Single-story, reinforced concrete frame.

(2) The following building types are normally used in light fabrication plants:

- Single-story, light-steel frame
- Single-story, load-bearing wall
- Single-story, reinforced concrete frame
- 0 Multistory, reinforced frame.

(3) Building roof types (Figure 1-7) also help identify specific fabrication industries. For example, the sawtooth roof is primarily found in light fabrication industries and monitor type roofs are common in heavy fabrication industries.



Frame 1-7. Roof Types.

d. Cranes are used throughout both heavy and light fabrication industries. These cranes vary in size, shape and use (Figures 1-8 thru 1-13).

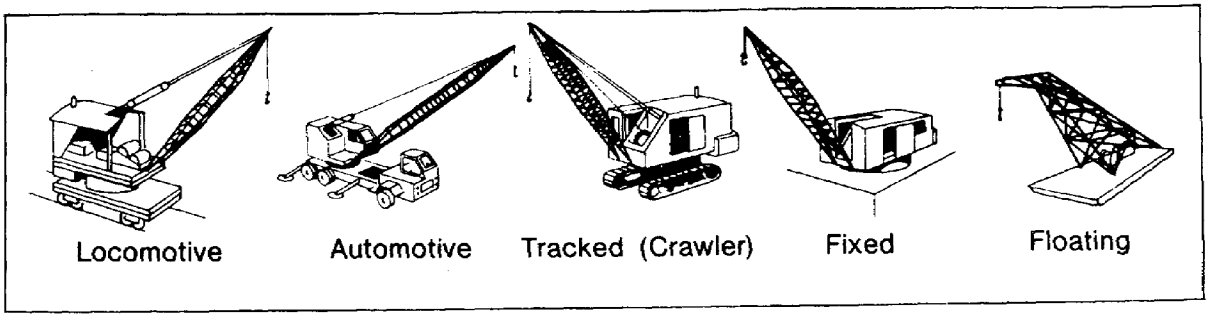


Figure 1-8. Small Jib Cranes.

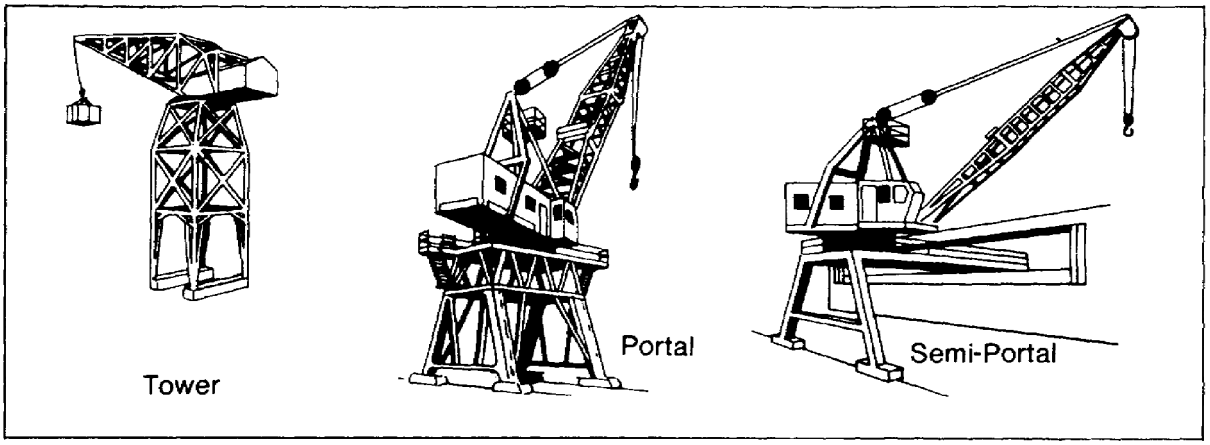


Figure 1-9. Large Jib Cranes.

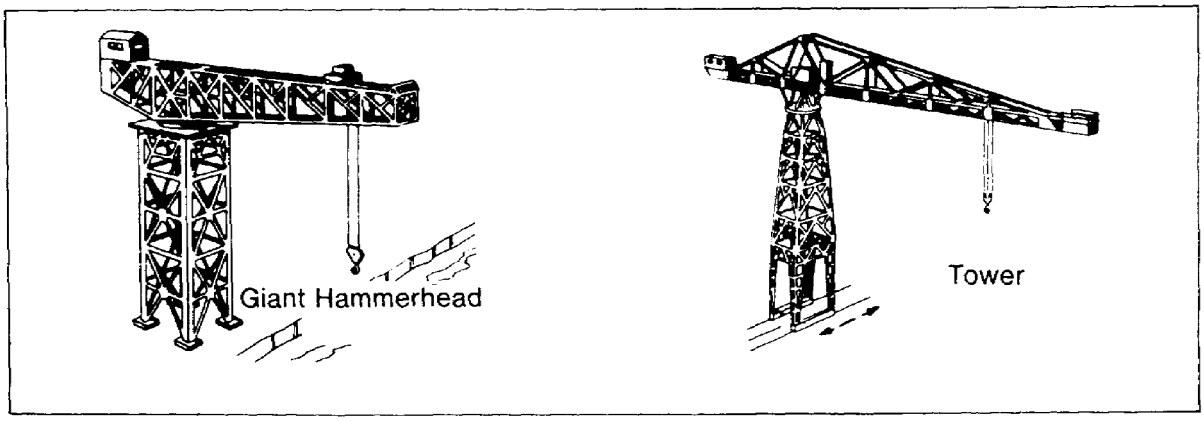


Figure 1-10. Cranes.

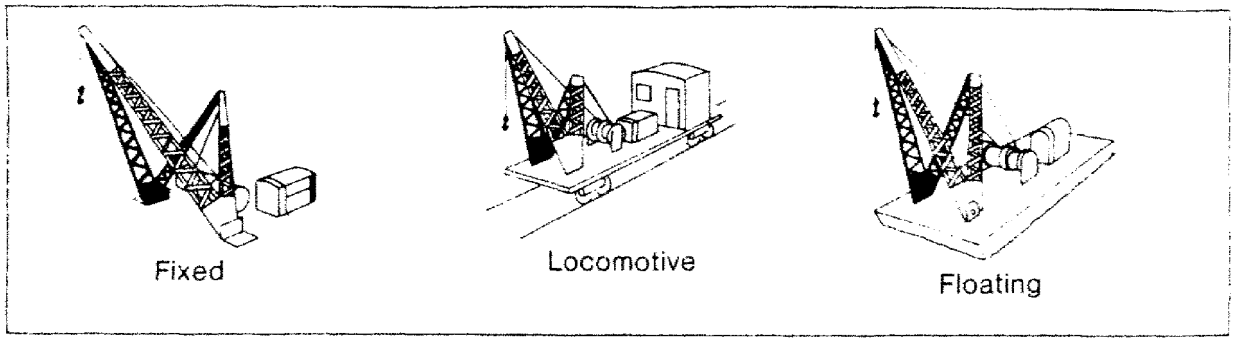


Figure 1-11. Shearleg Cranes.

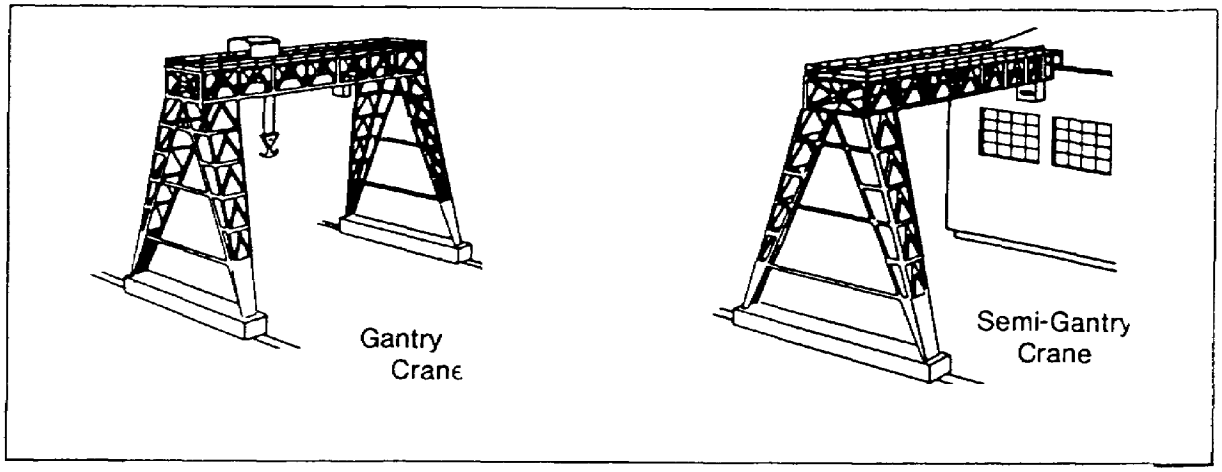


Figure 1-12. Gantry Cranes.

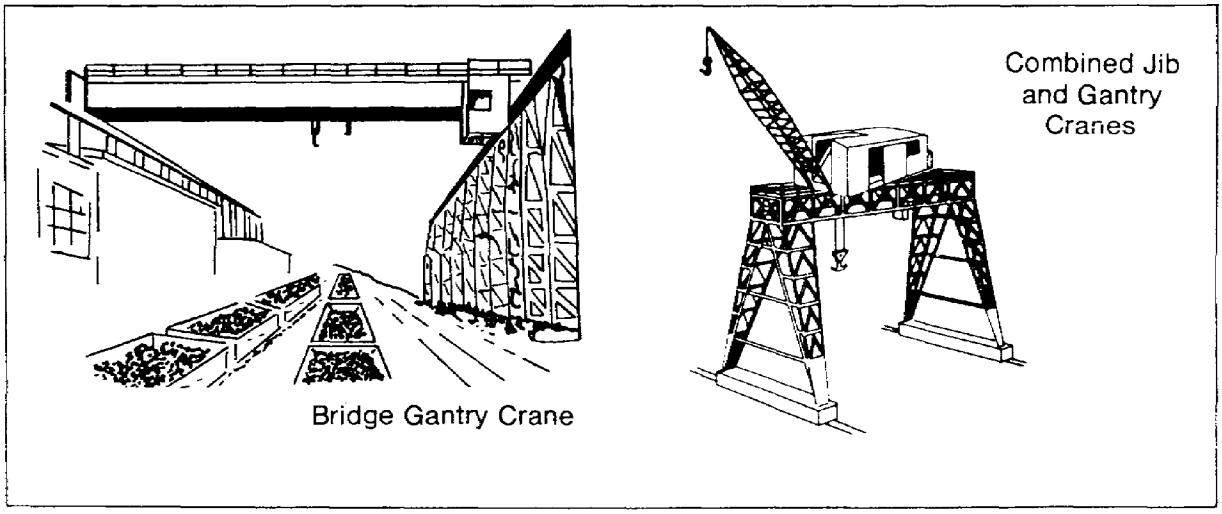


Figure 1-13. Jib and Gantry Cranes.

e. Storage tanks are not common in fabrication industries, but are sometimes found at heavy and light fabrication industries to hold fuel for the boilerhouse or some may hold water. These rarely aid in the identification of fabrication industries (Figure 1-14).

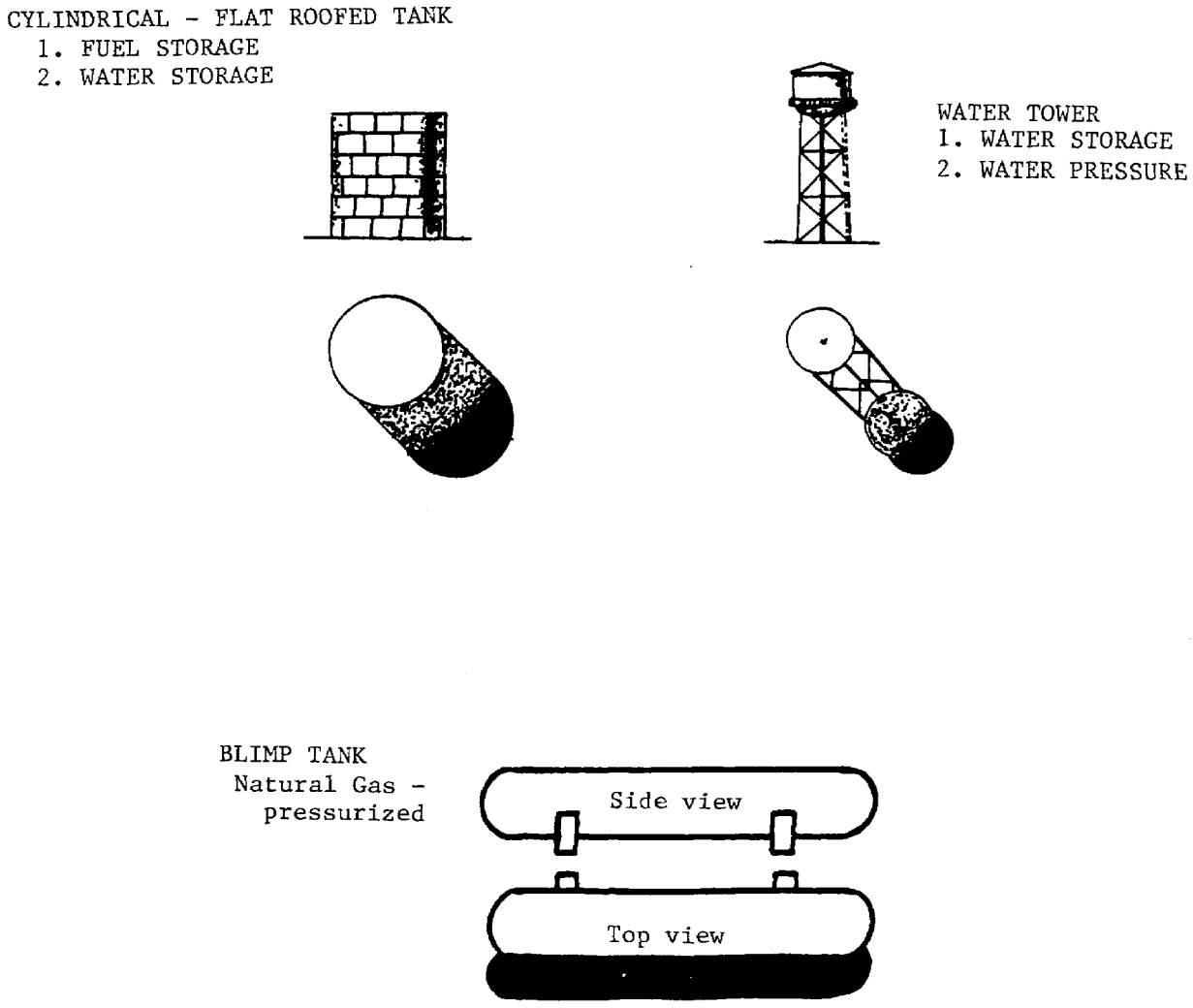


Figure 1-14. Storage Tanks.

f. You can see these clues are general and each has its exceptions, but they may be the only information available on which you can base your analysis. Therefore, it is important you--

(1) First classify a plant as either heavy or light fabrication.

(2) Second, research all possible sources of ground intelligence information.

(3) Third, identify as many of the components as possible.

(4) Finally, include a complete description of all identified and unidentified plant facilities in the industrial analysis report.

3. Heavy and light fabrication industries are closely related. It is often difficult to distinguish them due to the large number of industrial components associated with each industry.

a. The fabrication industry production flow (Figure 1-15) will help you understand the flow of materials once they arrive at the fabrication plant.

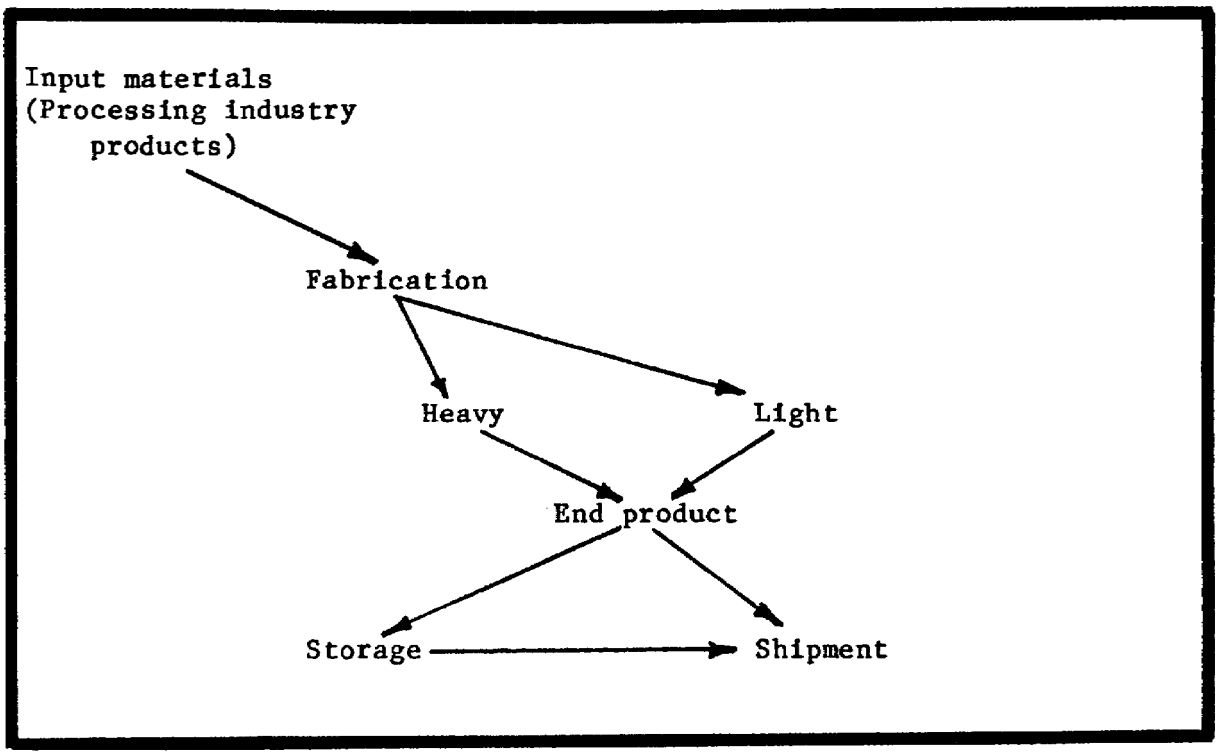


Figure 1-15. Fabrication Industry Production Flow.

b. The fabrication industry schematic (Figure 1-16) shows the relationship between the industry itself, the two subcategories, and their associated or specific industries.

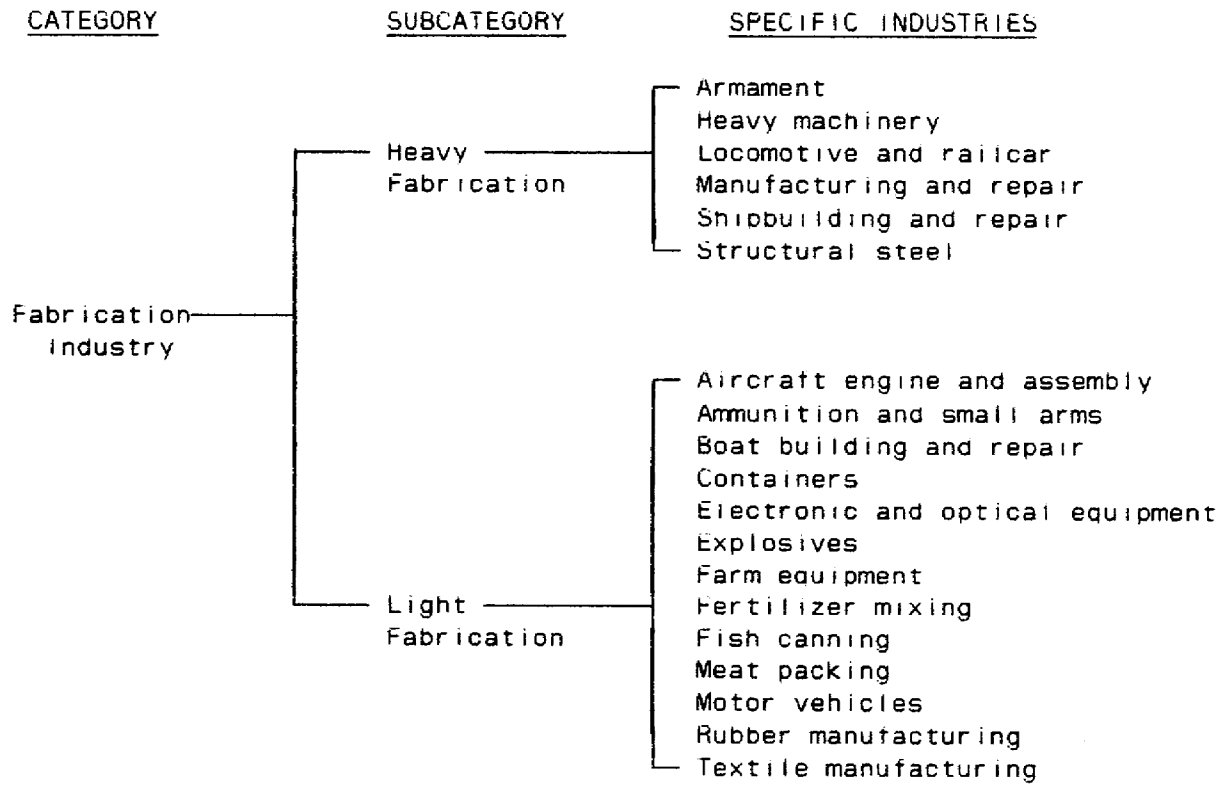


Figure 1-16. Fabrication Industry Schematic.

PART C: HEAVY FABRICATION INDUSTRIES

1. Heavy fabrication industries are those which use the end products of the processing industries to form and assemble finished products which individually are large and heavy. Major recognition features of heavy fabrication industries include:

- Large or small buildings
- Few facilities for storing or handling bulk materials
- Little outdoor equipment except cranes
- Little or no waste
- Heavy steel frame, single-story buildings
- Storage yards with heavy lifting equipment
- Rail lines entering buildings.

a. The industries in this category range from heavy machinery plants where all the fabrication of parts and the assembly are cone in one -or multistory, heavy, steel-frame buildings, to shipbuilding where the assembly usually is accomplished in the open. Five industries fall in the heavy fabrication category: ship building and repair, armament plants, locomotive and railcar manufacturing and repair, structural steel plants, and heavy machinery plants. The products of the heavy machinery plants include heavy electrical equipment, armament and diesel engines; however, the specific products cannot be determined unless they are observed outside the buildings.

b. The image components are divided into three major categories: equipment, buildings, and storage yards.

(1) Equipment is further divided into the headings: chimneys, stacks, and vents; tanks; pipelines, cranes, and mobile equipment; and complex equipment.

(a) Chimneys, stacks, and vents serve similar purposes--to dispose of heat, waste gases, and tine dust. Stacks are built of masonry or sheet metal, and vary in diameter and height. Stacks for a boiler house should be recognized as such to eliminate confusion with heat processing industries. Round, covered vents are common on many fabrication buildings and are used to disperse heat, dust, and fumes.

NOTE: The few stacks and vents associated with heavy fabrication industries do not aid in identifying the industry.

(b) Tanks are rarely found in heavy fabrication industries. The ones you do find hold fuel for the boiler house and others water (Figure 1-14).

(c) Pipelines, cranes, and mobile equipment are used to handle or transport materials. Pipelines rarely are seen at heavy fabrication industries. Cranes, however, are found in all heavy fabrication industries and used to handle large, heavy material. Overhead cranes (Figures 1-12 and 1-13) commonly span storage yards and move on elevated rails extending along both sides of the yard. The portal crane (Figure 1-9) and the giant hammerhead (Figure 1-10) are associated with shipbuilding. The portal crane moves on rails and has a slender room supported on a framework. It is used in assembling ships on the building ways. The giant hammerhead crane has a fixed base and a massive boom and is used for lifting heavy equipment into place at the fitting-out berth. Cranes and their associated components frequently aid in the identification of an industry. Mobile equipment such as the traverser and round table move or rotate locomotive and railcars and are found at both locomotive and railcar manufacturing and repair plants.

(d) Complex equipment is limited to one industry, shipbuilding. Graving docks, floating drydocks, side launching ways, and various types of building ways identify the shipbuilding industry.

(2) Buildings are present in three subdivisions based on function; fabrication, storage, and administration.

NOTE: Although the nature of the image components is somewhat different for each subdivision, no single building specifically identifies industry; however, certain buildings in association with other components will provide the analysis of an industry.

(a) Fabrication buildings are the most obvious image components at heavy fabrication industries. The design of these buildings, in conjunction with crane-served storage yards, are the chief recognition features for this category. These one-story fabrication buildings have wide bays, a heavy steel-frame, and adequate head room for the operation oft overhead traveling cranes which may also serve the adjacent storage yards. The roots of heavy fabrication buildings often have monitors, either longitudinal or transverse, which reveal the width of the bays. Large and heavy incoming materials and manufactured products of the plant are unloaded and loaded directly on and off railcars in these buildings. Rail lines frequently enter some of the buildings at heavy fabrication plants.

(b) Storage buildings are not common in this category. Various sections of the fabrication building are used for the storage of small parts and such materials as steel plates. Large parts usually are stored in the open. The manufactured goods usually are shipped out as soon as they are assembled.

(c) Administration buildings are usually built to one side of the plant near the main entrance and are served by walks, driveways, and parking areas. The grounds around them may be landscaped.

(3) Storage yards are either regular in shape and served by cranes, or irregular in outline and lacking cranes. All the heavy fabrication industries nave crane-served storage yards for such goods as steel plates, beams, and heavy parts. Open storage yards with no cranes are used for such things as railcars as well as lumber, scrap iron, and steel.

REMEMBER: The design of the buildings and the storage yards with their associated cranes confirm heavy fabrication facilities and frequently identify the individual industries. Additionally, the complex equipment used in building ships identifies that industry.

2. For a nation to have an important shipbuilding industry, it must have adequate harbors and water areas in which to launch and use its vessels. It also must have an adequate transportation system for transporting the materials from their sources to the shipyards.

a. The location of shipyards in a country depends upon three factors. First, the shipyard must be on a protected body or water of sufficient size and depth to launch any snip produced. Second, the body of water must nave access to the sea. Third, the country must have an adequate inland transportation system.

b. Although the layout of a shipyard varies from country to country, the basic facilities or the yards are the same throughout the world.

c. Figure 1-17 illustrates the sequence of operations used in shipbuilding. Compare it with the following description of the production flow of shipbuilding:

(1) Design and layout operations take place in a building called the mold loft. The plans for the ship (blueprints) are drawn in the engineering and drafting departments and then sent to the mold loft. the ship's lines are laid out on the mold floor at full size to determine the exact dimensions of the important parts of the ship's null.

(a) In general, the mold loft operation is divided into two phases: the laying out of the ship's lines, and the carpentry work involved in making wooden templates, which are used as patterns for the bulkheads and frames.

(b) Mold lofts are usually long and nave a continuous, unobstructed floor of sufficient width to permit laying down the full depth of the ship's null. Because of the close operational sequence involved, the mold loft is usually adjacent to or part of the fabrication shop. It is common practice to locate the mold loft above the fabrication shop.

(2) Fabrication. When the mold loft designers complete the templates, they are issued directly to the fabrication building. At the same time, steel plates are brought in from the storage yards by a system of cranes. Notice the storage yard just outside the fabrication building in Figure 1-17.

(a) Fabrication is the process of cutting and shaping raw steel into structural members. The operation may be performed in one or more fabrication buildings.

(b) Power for the fabrication operation usually comes from the shipyard's own power plant, which is often near the fabrication area.

(c) The four main features of the fabrication building in the shipbuilding industry are:

- Large, trussed-roof steel-frame buildings with evidence of tracks leading inside
- Overhead, traveling gantry cranes, which lift stored and fabricated materials, adjacent to the buildings
- Usually located between the storage and the assembly area
- Usually the largest building.

(3) Assembly. After the plates, angles, and channels are prepared in the fabrication shop, the next step is to fit the parts together by riveting or welding.

(a) In many cases, assembly work takes place in the fabrication shop. It also can be done in separate buildings near the shipbuilding ways.

(b) Another common practice is to assemble units on slabs.

These assembly slabs, it present, are located beside or in front of the shipbuilding ways and are serviced by overhead gantry cranes. In many cases, portable roots are provided for protection. If separate assembly buildings are used, they are located between the fabrication shops and the shipbuilding ways.

(4) Erection. Hull erection consists of hoisting the parts of the ship's hull into place and securing them by riveting or welding. Material for the hull comes from the fabrication shops, assembly shops, and the storage areas. This material is transported and hoisted into place by a crane network which spans the shipbuilding ways.

(a) Erection takes place on the shipbuilding ways. The term "building way" generally refers to the space where the ship is constructed. Ways built perpendicular to or at an angle to the shore are for end launching. In other words, the stern enters the water first when the ship is launched. Some shipbuilding ways, however, are built broadside to the shore and used for side launching.

(b) The center of the building way is called the ground way and follows the natural slope of the land so the ship can slip into the water by gravity when the keel blocks, shoring, and wedges are pulled. Before erection is started, the ground ways are greased to aid in launching the ship.

(5) Launching is the process of transferring the hull from the building ways, or graving dock, to the water; the launchway can be identified by its location close to the waterway and tracks carrying the ship. A graving dock is a large basin normally fitted with gates on the seaward side; various cranes are alongside the basin (Annotation 9, Figure 1-i8).

NOTE: When a ship is first launched, she is seldom over 70 percent complete. In most cases, she still lacks her engines, boilers, armament, plumbing, and ventilating, electrical and auxiliary equipment. These are normally installed at the fitting out area.

(6) Fitting out pier. As soon as the ship is launched, she is towed to a fitting-out pier (wet dock) with gates at the seaward side, where fitting-our takes place. Depending upon the extent of the fitting-out work, she may remain in the wet dock for a period ranging from weeks to months. For example, a freighter may require from one to three months for fitting out, but a large warship may require four to ten months.

(a) For the fitting-out work, the area is well equipped with storage sheds, shops, engineering buildings, boilers or power plants, and cranes. The various buildings make up the engineering area.

(b) The ship is completely finished at the fitting-out piers. When she is considered seaworthy, she is moved away under her own power for seatrials. Upon completion of seatrials she is then moved out for service in the fleet.

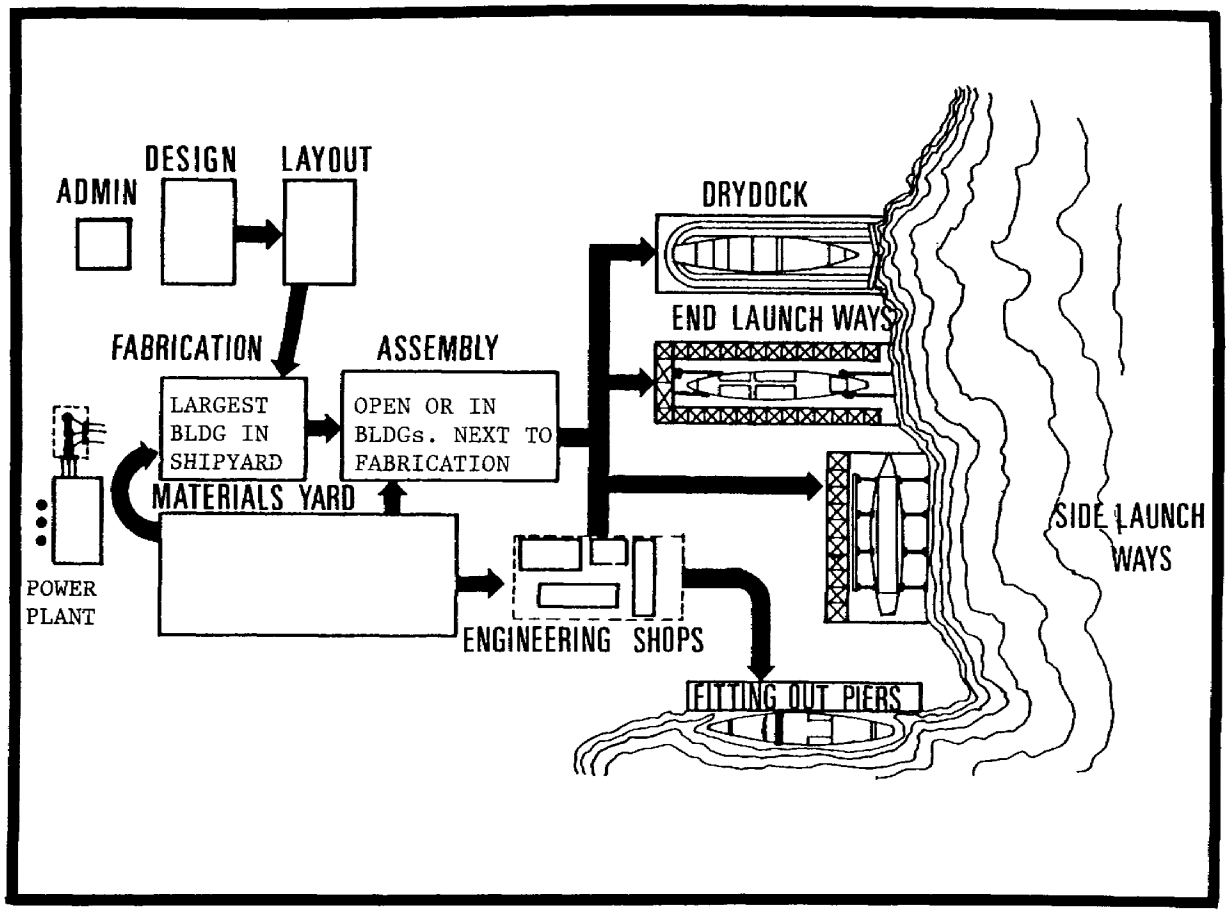


Figure 1-17. Shipyard Components.

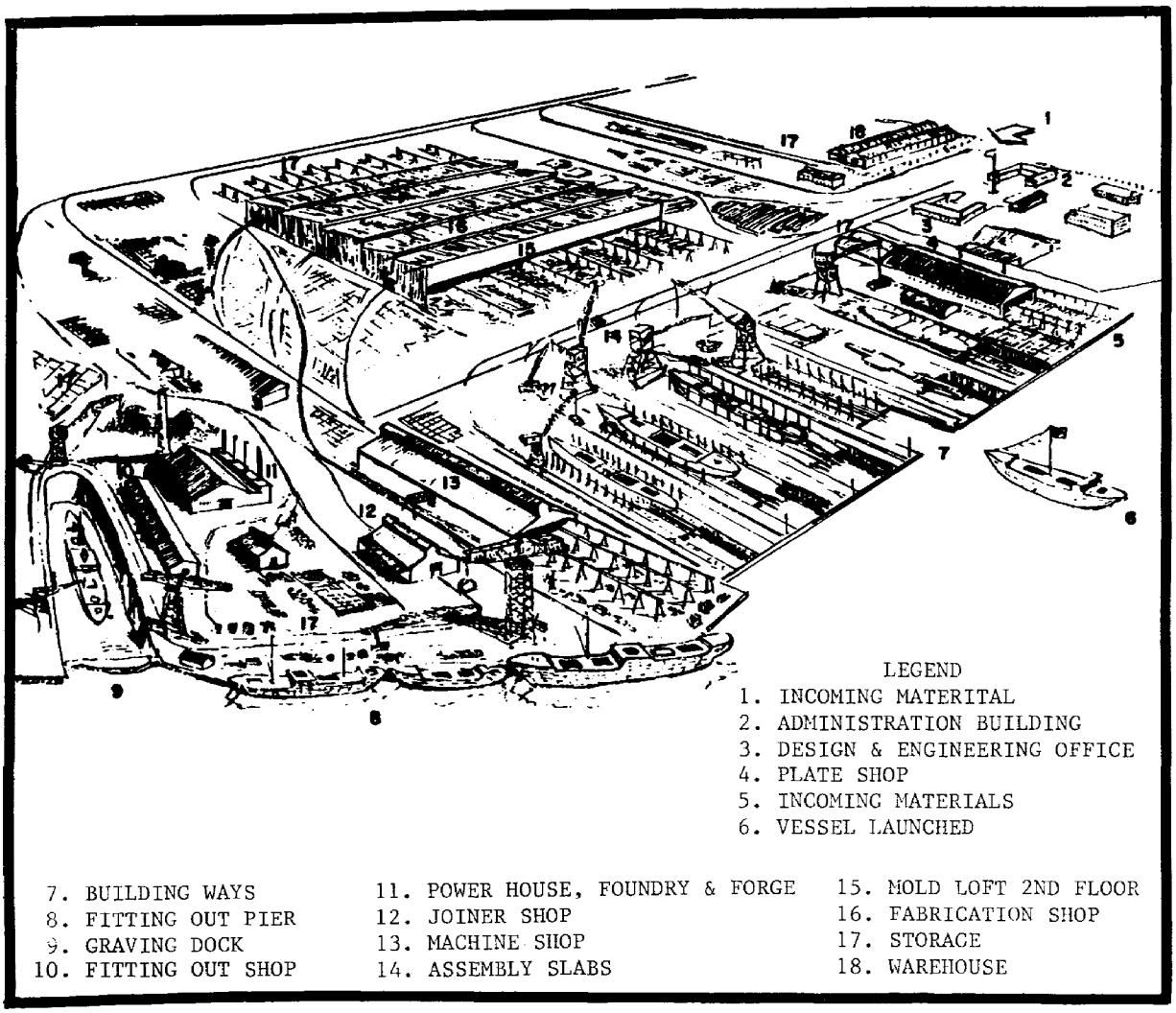


Figure 1-18. Theoretical Shipyard Layout.

d. Figure 1-19 illustrates and describes the basic steps of standard ship construction.

1 **A** Keel blocks are laid at intervals along the center of the building area for the entire length of the ship. They are built up in sections sufficiently high for men to work on the ship's bottom and their tops are aligned to conform to the slope required for launching.
B Sections of the flat keel plates beginning amidships are lowered on to the building blocks and the connecting butt straps are bolted.
C Plates of the vertical keel are next located on top of the flat keel.

2 **D** Timber braces (spauls) are set at the angle of the ship's bottom and, starting at the lowest strake, the bottom plating is erected as far outboard as the turn of the bilge.
E Floors, which are transverse vertical plates, are erected at intervals on top of the flat keel and bottom plating.

3 **F** The double bottom is then completed by adding the tank top plating and margin plates.
G To aid in erecting the shell plating and frames, staging or scaffolding is built around the entire ship. As the staging is kept to within a few feet of the ship's side and extends to the main deck, conforming to the exact plan shape of the hull, it has often been confused in an aerial photograph as being the actual side of the ship.

4 **H** Side frames are next hoisted into place at intervals corresponding to the various floors.
I Bulkheads (transverse and longitudinal) are next erected, beginning with the bulkheads that surround the machinery spaces. At this time the engine and boiler foundations are often put in place.

5 **J** The shell plating is then connected to the frames, continuing from the bilge up to the main deck.
K As the hull takes shape, the beams and girders are erected and decks are plated up. If the engines are installed after launching, portions of the decks are left open for access.
L Forged members such as stem and bow frames are erected after the framing is complete.

6 **M** The superstructure, which is built above the the main deck, is erected during the final stages of construction.

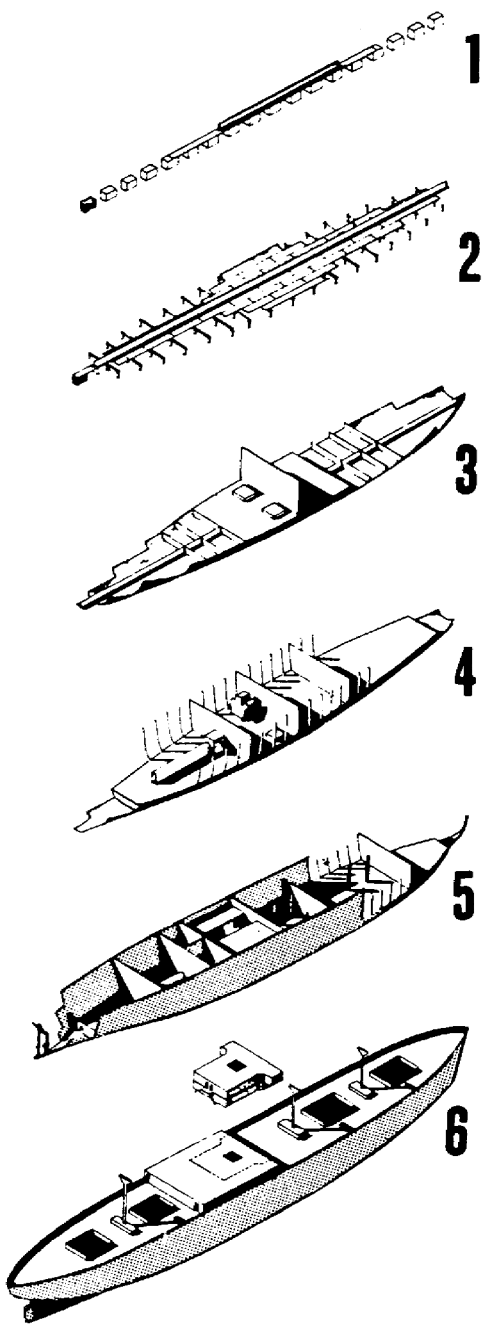


Figure 1-19. Steps of Standard Ship Construction.

e. In the following pages examples of the main image components of shipbuilding are shown and described.

(1) The largest building, the fabrication building, is where the mold loft is made (Figure 1-20).

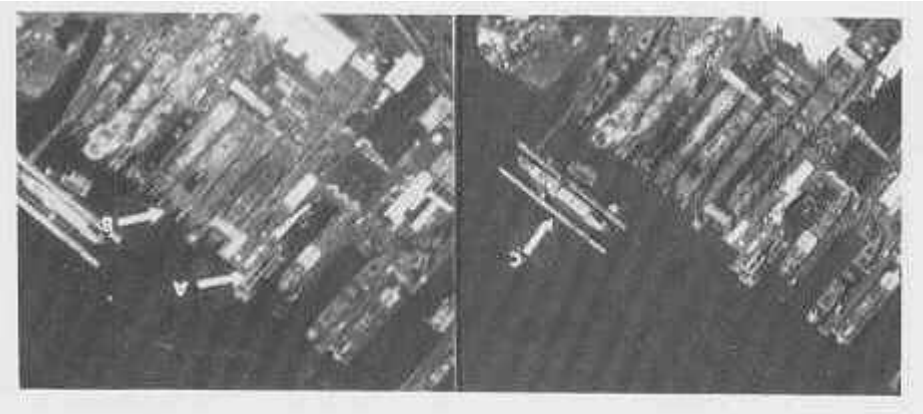


Figure 1-20. Fabrication Building.

(2) The fitting out berth (Annotation A, Figure 1-21) is where the snip's final assembly is completed after launching; the slipways (Annotation B) are the areas where the ship's hulls are assembled and launched; and the floating drydocks (Annotation C) are where the ships are being repaired.

Figure 1-21. Fitting out Berth, Slipway, and Floating Drydock.

(3) The steel frames and plates from the fabrication building are assembled on the inclined building ways (Figure 1-22). The parts are lifted into place by overhead cranes. When the hull and decks are completed, the snips are launched and towed to the fitting-out berth.

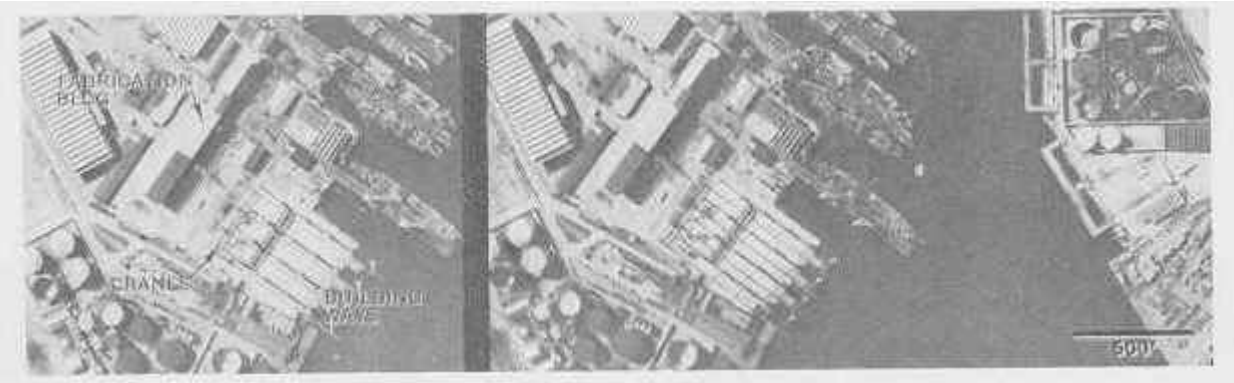


Figure 1-22. Building Ways.

(4) Graving docks (Figure 1-23) are long narrow basins constructed into the shoreline. They have a solid bottom and sides, and a moveable gate or cassion at water end. Ships are constructed or repaired in these docks. Water is pumped out when work is underway and pumped back in to allow the ship to leave the dock.

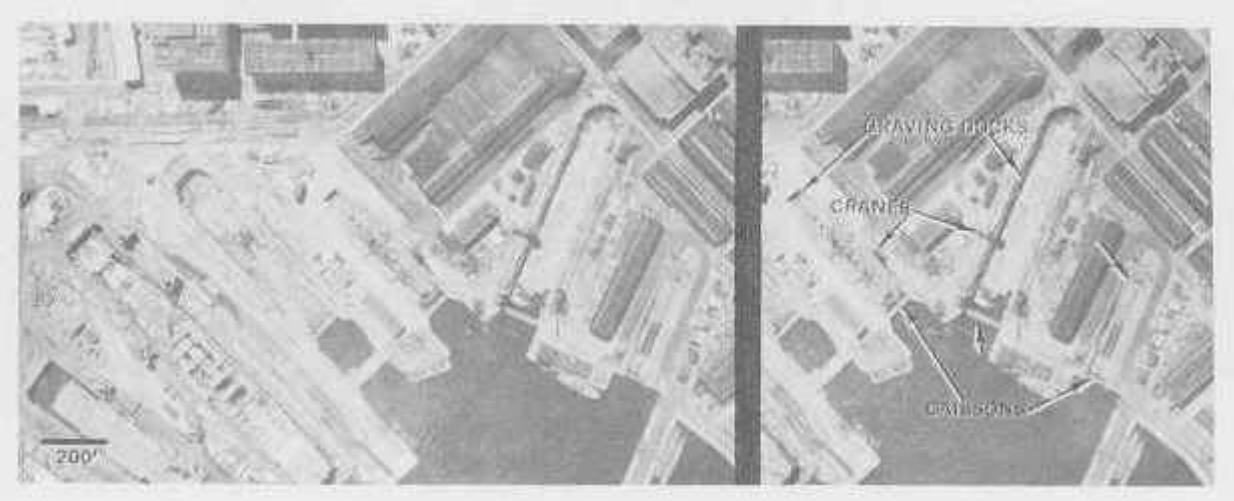


Figure 1-23. Graving Docks.

(5) Frames and precut steel plates from the fabrication buildings are carried by overhead bridge gantry cranes and lowered into place at building ways. The cranes move on rails supported by heavy steel framework that extends the length of the building ways (Figure 1-24).

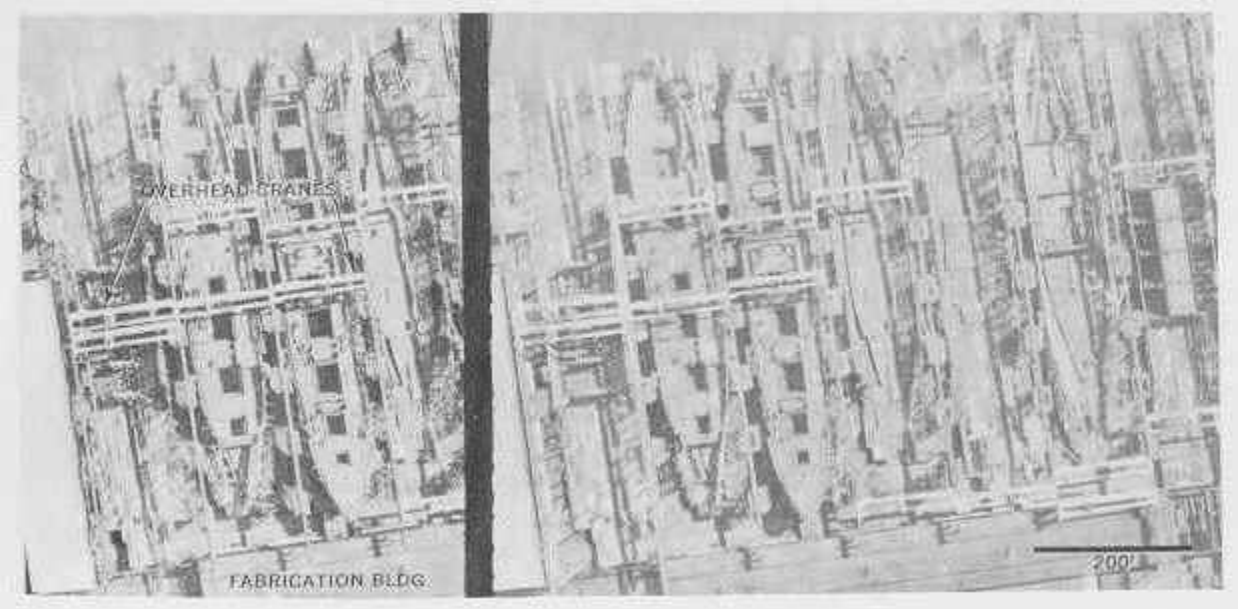


Figure 1-24. Overhead Gantry Cranes.

(6) Portal cranes at building ways are mounted on rails and nave a boom that rotates in a complete circle and can be raised and lowered (Figure 1-25). They are used at fitting-out berths and dry docks.

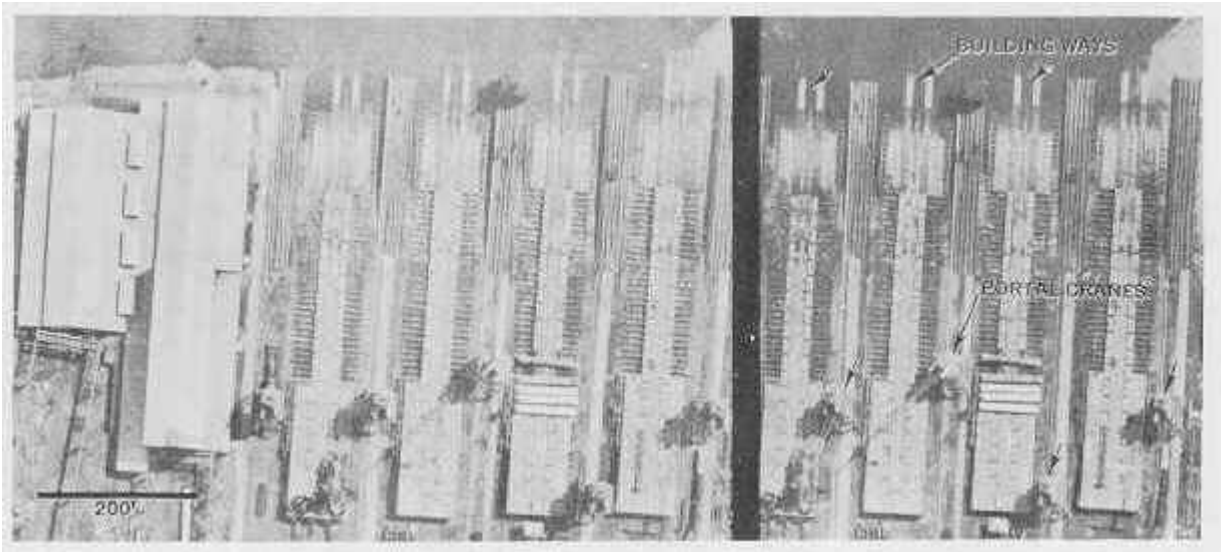


Figure 1-25. Portal Cranes,

(7) A giant hammerhead crane is used to install propulsion equipment, gun turrets, and heavy parts on ships at the fitting-out berth (Figure 1-26).

Figure 1-26. Giant Hammerhead Crane.

3. Fabrication and assembly plants are the industries involving production of armaments, rail cars, heavy machinery, and steel products. Both fabrication and assembly plants nave extension storage areas, foundries, forges, machine shops and assembly areas.

a. The fabrication and assembly process is discussed on the following pages. Use Figure 1-27 as reference.

(1) Receiving and storage area is customarily near the incoming rail or highway transportation network. This area consists of outside and inside (warehouse) storage facilities. In heavy assembly plants, you commonly find gantry cranes over the storage yards for handling heavy raw materials. If warehouses are used, expect to find long, single-story, lightly constructed buildings.

NOTE: If large-scale photography is available, the receiving and storage area may give clues to the type of equipment being manufactured. This is especially true it a plant receives certain subassemblies from another plant.

(2) Pattern shops and pattern-storage buildings. Before the die for a press is cast or before a foundry mold is made, a pattern is produced. Wooden patterns are usually used and produced in a typical woodworking shop (pattern shop) located near the foundry. The pattern shop can be identified by a sawdust catcher on the side or on top of the building.

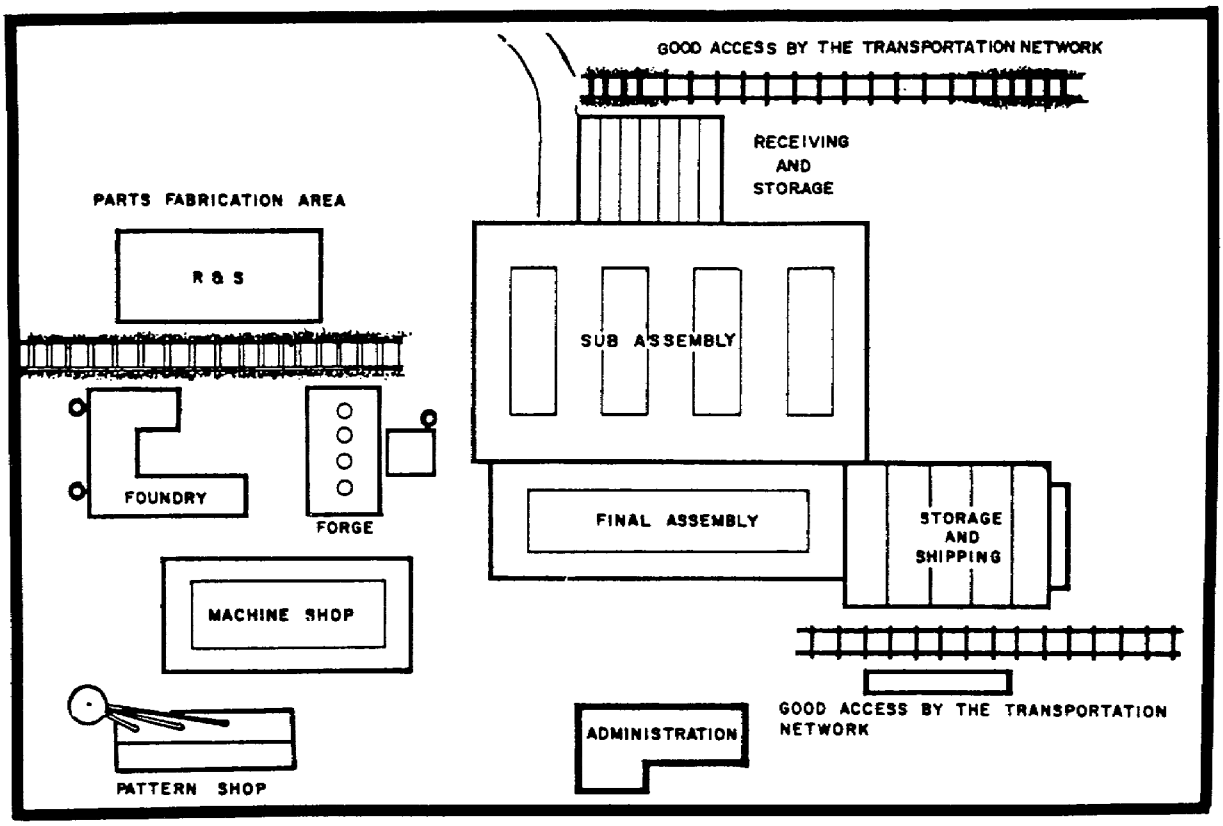


Figure 1-27. Heavy Fabrication and Assembly.

NOTE: After the patterns are made and used for their intended purpose, they are stored until needed again. Most assembly plants store their patterns for an extended period. Consequently, you usually find a pattern storage building near the pattern shop. Since most patterns are combustible, the pattern-storage building is often divided by firewalls.

(3) Foundries. A foundry melts and pours metal into molds. The process is called casting and accomplished with either sand or permanent metal molds. Sand casting molds are customarily formed with wooden patterns made in the pattern shop.

(a) Most foundry buildings are well-ventilated, single-story buildings. The area around the building is usually cluttered with molds, cast parts, and scrap metal. Sand stockpiles may be visible if sand molds are used.

(b) Since the foundry has a melting furnace, a stack and a fuel supply are necessary, unless electric furnaces are used. In the latter case, a substation is required. It extremely heavy castings are produced, a crane is necessary.

(4) Forges shape metal into the desired form by using presses or drop hammers to process unmelted metal into shape. A forge resembles a foundry in appearance. In fact, forges and foundries are so similar they are often combined facilities. If so, the only indication of a forging operation is an external power supply, such as a boiler house or a generator house, which supplies power for operating the presses and drop hammers.

(5) Machine shops. The amount of machine shop work done in fabrication and assembly plants varies considerably from plant to plant and depends upon the amount of work subcontracted to other plants.

(a) Forgings and castings that are machine finished, drilled, or threaded are processed in the machine shops as are bars, rods, tubing, plates, and heavy gauge metal.

(b) Machined parts flow to virtually every department of an assembly plant, and many of these parts are neat-treated and painted before they go to the subassembly areas. For this reason, a location that provides access to these various departments is a logical place for the machine shops.

(c) In addition to their relationship to the neat-treating, painting, and subassembly departments, machine shops are normally adjacent to the following areas:

- Tool room
- Engineering department
- Planning department
- Stockroom
- Raw stock storage
- Metal fittings departments.

(d) After the parts are machined, they are usually heat-treated to give them maximum hardness and strength. Then they are given a protective coating of paint or other protective material. Heat-treating and painting are normally done in the machine shops. Fumes and vapors from these operations are vented through the roof, and ventilators and root stains are valuable for identifying the area.

NOTE: Machine shops require a maximum amount of interior lighting. For this reason, the buildings have sawtooth roofs, monitor roots, or other types of roof lighting. The interior of a machine shop building is usually 15 to 25 feet high.

(6) Assembly areas. There are two types of assembly areas: subassembly and final assembly. The individual parts from the machine

shops are joined together to form subassemblies. Examples of subassemblies are the wings, landing gear, and the control surfaces of an aircraft. The individual subassemblies are then joined to form the final assembly of a finished product.

(a) Since the subassembly and final assembly areas usually occupy the same building, you are seldom able to identify where one process begins and the other ends. But if you remember subassembly follows machining and final assembly follows subassembly, you can trace the flow in most plants.

(b) it is best to start your analysis by identifying final assembly. Look for loading docks, outside storage of finished products, and transportation lines leading to the building. Then look for heat-treating vents and paint stains on the root.

REMEMBER: This locates the machine shop area, and subassembly is located between the machine shops and final assembly. The remainder of the plant facilities should then fall into place.

b. Armament plant produce such products as tanks and self-propelled guns. Specific identification features of armament plants include:

(1) The plants are rail-served, and generally located near urban areas.

(2) Large quantities of water are necessary and are usually present.

(3) Buildings may be indistinguishable from those of a railroad car manufacturing plant.

NOTE: A tank plant may have security measures such as guards and high fences.

(4) The armament building is a large, nigh, clear span structure with rail lines entering the building. A crane-serviced area may be adjacent to the building.

(5) A test track will be within the plant area, or in the vicinity.

(6) Large forges and extensive casting facilities are common, as well as heating and power plants, and maintenance and tooling shops.

(7) Input materials and end products are visible.

(a) Input materials include: pig iron, ingot steel, steel castings, and components such as track links, engines, turrets, and gun barrels.

(b) End products include: tanks or self-propelled guns which will be shipped by rail or driven into a local depot.

c. Steel and rail car manufacturing plants.

(1) In a steel fabrication building (Figure 1-28) structural steel from the storage yard :s cut and made ready for assembly.

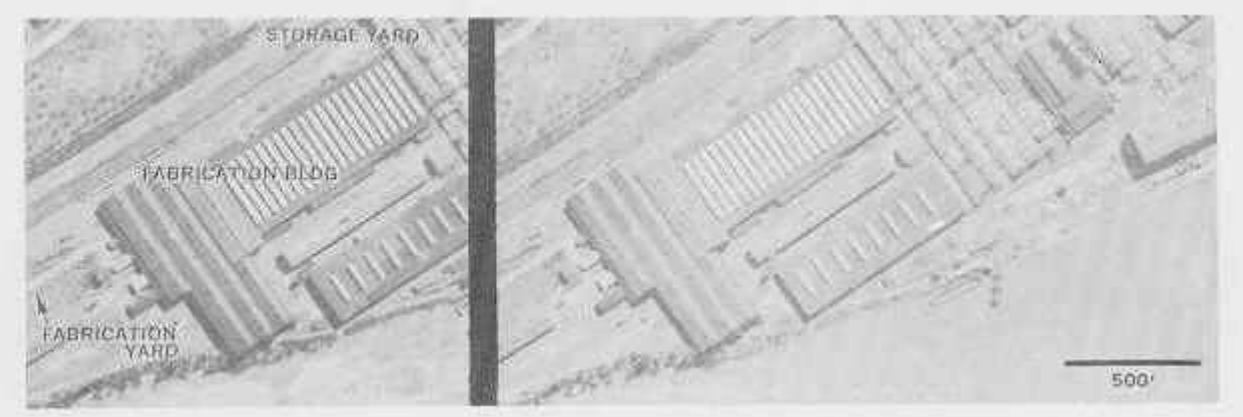


Figure 1-28. Steel Fabrication Building.

(2) In a rail car manufacturing and repair plant, many rail spurs enter the fabrication buildings where rail cars are assembled or repaired directly on the rails. The one-story, monitor roof buildings are high and heavily constructed to support overhead cranes. Parts are stored in the crane-served yard (Figure 1-29).

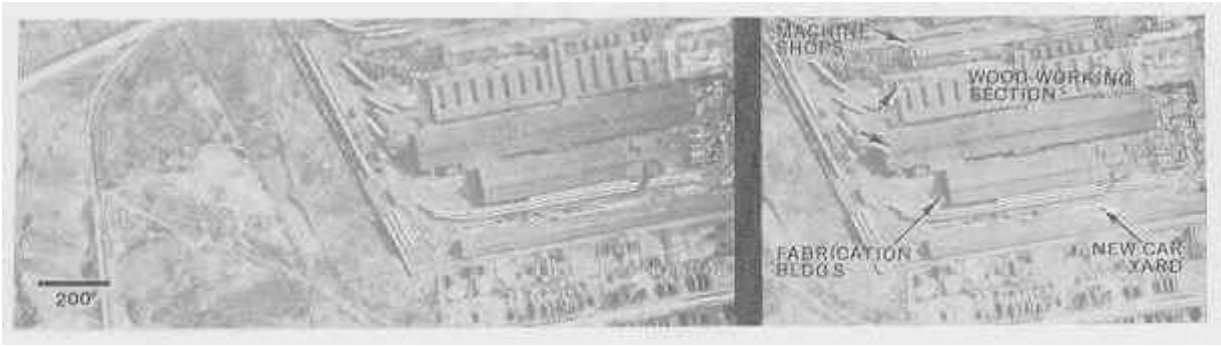


Figure 1-29. Rail Car Plant.

d. The products of the heavy machinery plants (Figure 1-30) include heavy electrical equipment, and armament and diesel engines. The specific products cannot be determined unless they are observed outside the buildings.

(1) Fabrication and assembly buildings have heavy steel frames to accommodate overhead traveling cranes.

(2) Rail spurs enter the largest building so the finished heavy equipment can be loaded directly onto rail cars for shipment.

NOTE: Specific products can be identified in rare instances and only when they are exposed and recognized outside the plant.

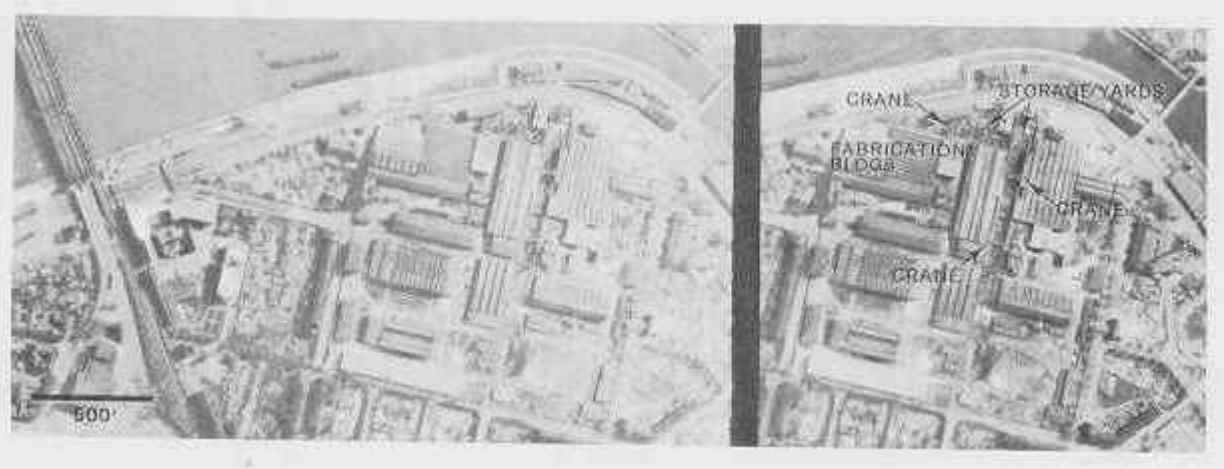


Figure 1-30. Heavy Machinery Plant.

(3) Short vents in an electric furnace building (Figure 1-31) allow heat and fumes to escape. Those furnaces produce high quality alloy steel.

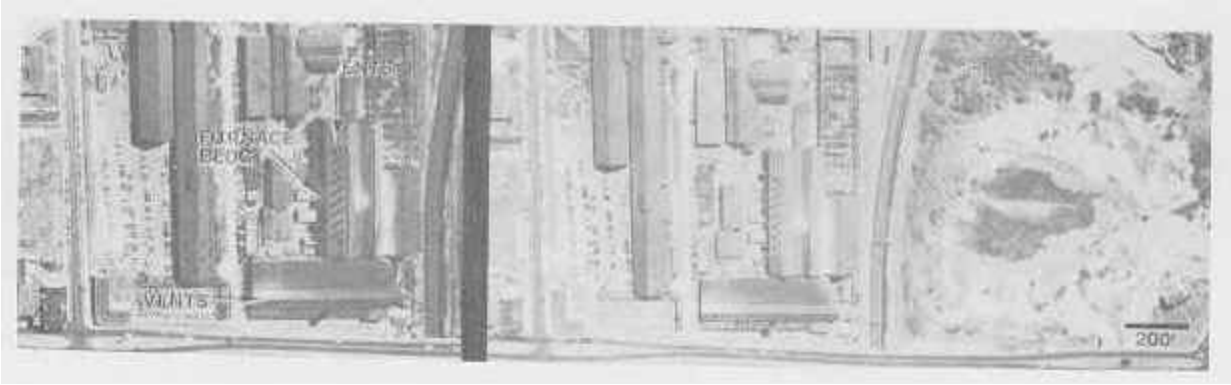


Figure 1-31. Short vents on an Electric Furnace Building.

(4) Boiler house (Figure 1-32). Steam is used to operate equipment in the fabrication buildings. A boiler house is also used for heating and can be identified by its large conspicuous stack.

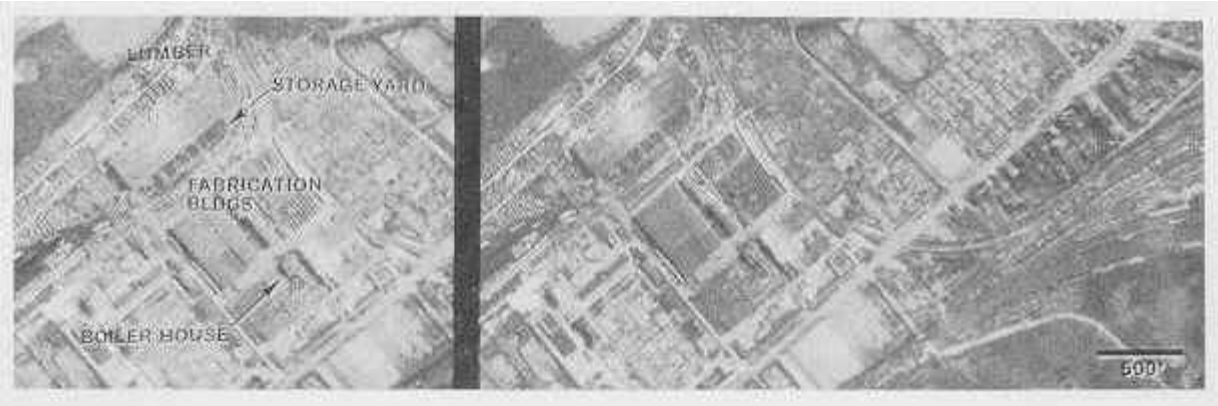


Figure 1-32. Boiler House.

PART D: LIGHT FABRICATION INDUSTRIES

1. Light fabrication industries are those which fabricate and assemble finished products which are not exceptionally heavy or bulky. The majority of industrial plants will be light fabrication. Major recognition features of light fabrication industries:

- Few facilities for storing or handling bulk materials
- Little outdoor equipment except cranes
- Little or no waste
- Large or small buildings
- Little outdoor equipment except cranes
- Light steel or wood frame buildings and wall-bearing multistory structures
- Lack of heavy lifting equipment
- Few open storage areas.

a. The industries in this category range from aircraft assembly and motor vehicle plants where the individual buildings cover a large area and are closely grouped, to explosive plants where the buildings are small and widely dispersed or heavily revetted. Most of the industries which fall in this category cannot be positively identified from their image components alone unless specific products can be observed outside the buildings. These unidentifiable industries include plants producing electronic and optical equipment, textiles, and rubber. Such industries are identified as belonging in the light fabrication category. Those industries which can be identified produce such things as aircraft, food products, explosives, and motor vehicles.

b. The image components are divided into three major categories: equipment, buildings, and storage yards.

(1) Equipment is further divided into the headings chimneys, stacks and vents; silos and tanks; pipelines, conveyors, and cranes; and complex equipment.

(a) Chimneys, stacks, and vents serve similar purposes--to dispose of the waste gases, heat, and fine dust. Stacks are constructed of masonry or sheet metal, and vary in diameter and height. A light fabrication industry may have a conspicuous stack associated with a boiler house which supplies steam to operate equipment and heat the buildings. Small vents provide free circulation of air in the building.

NOTE: The few stacks and vents associated with light fabrication industries do not aid in identifying the industry.

(b) Silos are tall, covered cylindrical containers which hold dry bulk materials. The few tanks present usually hold fuel for the boiler house or water.

NOTE: Silos and tanks are rarely found in light fabrication industries and do not help in identification.

(c) Pipelines, conveyors and cranes are used to handle or transport materials. Pipelines are few, and conveyors are rarely used; however, ramps are used at meat packing, fertilizer mixing, and seaplane assembly plants. Cranes are unusual in the light fabrication industries.

(d) Complex equipment is limited in the light fabrication industries. Building ways, launching ways, and marine railways are utilized in boat building and repair. Other complex image components include wind tunnels and firing ranges.

(2) Buildings based on function are placed in three subdivisions: fabrication, storage, and administration. Although the nature of the image components is somewhat different for each subdivision, buildings rarely identify a specific industry. However, certain buildings in association with other components will provide the identity of an industry.

(a) Fabrication buildings are the most obvious image components in light fabrication industries. Fabrication buildings may be multistory, wall-bearing brick buildings; large, one-story, light, steel-frame structures; or small wood-frame buildings. In the multistory, wall-bearing brick buildings the heavy walls support the entire weight of the structure. Such buildings are used for a wide variety of products, and most of the industries are not identifiable.

NOTE: In many light fabrication industries, the wall-bearing buildings are being replaced by one-story, light steel-frame structures adaptable to many different operations. The roofs of these buildings frequently have monitors which do not necessarily indicate the width of bays. The monitors provide lighting and free air circulation in the buildings. Brick curtain walls are commonly used for exterior walls and do not support any weight except their own. Frequently, buildings in light fabrication industries cover as much or more area than those in heavy fabrication industries. Among the largest fabrication buildings are those at aircraft assembly plants. Aircraft engine test cells are unique and identity the industry. Small fabrication buildings are not of particular value for identification.

(b) Storage buildings are few in this category. Various sections of the fabrication buildings are used for the storage of small parts as well as the finished products. Explosive warehouses are usually revetted or covered, and in some cases widely dispersed. Warehouses usually are served by railroad.

(c) Administration buildings usually are built to one side of the plant area near the main entrance and served by walks, driveways, and parking areas. The grounds around them may be landscaped.

(3) Storage yards for raw materials and parts are rare in light fabrication industries. The lack of storage yards with associated cranes distinguishes these industries from those in the heavy fabrication category. Finished products stored or fabricated outdoors frequently identify the industry. Such recognizable finished products include trucks, automobiles, aircraft, boats, or cable. Holding pens for livestock help identify meat packing plants.

REMEMBER: The design, of the buildings and the lack of crane-served storage yards confirm light fabrication industries. Test cells are diagnostic of aircraft engine plants. Recognizable finished products, stored or fabricated outdoors, are of primary importance for identifying some light fabrication industries. Complex equipment helps identify boat building and repair.

2. The presence of an aircraft/missile industry is indicative of a sophisticated level of military technology. Only the richest and most advanced nations can support an indigenous aerospace capability which, aside from nuclear technology, has become the primary strategic military asset.

a. Aircraft industries have five manufacturing subdivision: aircraft assembly, aircraft engine, components, propeller, and jet propulsion. Some of these subdivisions can be found at one or different locations. For example, one engine plant may build all of the engines used at four aircraft engine and assembly plants; a dozen component manufacturers may supply the engine plant, while some of the same component plants may make parts for other aircraft assembly plants.

b. An aircraft assembly plant generally offers very few clues to the activity taking place under its large roof area. Some plants perform the entire operation under one large roof; others use separate buildings for each operations. Follow Figure 1-33 while studying the production plan of an aircraft assembly plant.

(1) The area around Annotation 1 is the receiving and storage area. Notice the transportation line leading to this area. The area contains both outside and warehouse storage.

NOTE: Storage can also be inside the main assembly building.

(2) Annotation 2 is a foundry. An aircraft plant uses a foundry primarily to cast dies for the sheet metal presses that operate inside the machine shop area. Permanent mold casting is normally used.

(3) Notice the heat-treating vents and paint stains at Annotation 3. This identifies the machine shops. Next to the machine shops, in the same building, is the subassembly area (Annotation 4). Normally you would identify the machine shop first before identifying the subassembly area.

(4) Annotation 5 depicts the final assembly building. The final assembly building in the aircraft industry is often taller than the subassembly building in order to accommodate aircraft with extremely tall vertical stabilizers. Your best clue, however, for locating final assembly in the aircraft industry is the wide apron with parked aircraft.

(5) After an aircraft is completed, it undergoes a series of ground tests before the first flight test. these tests usually begin after the aircraft is towed to the checkout hangar (Annotation 6). In the checkout hangar, various hydraulic, electrical, and control tests are performed to ensure the aircraft is airworthy.

(6) After the ground checks are performed, the aircraft is towed to the parking apron for engine runup. Around some jet aircraft plants, you can find large noise suppressors (mufflers) which are positioned behind the jet exhaust pipes to reduce noise during runup.

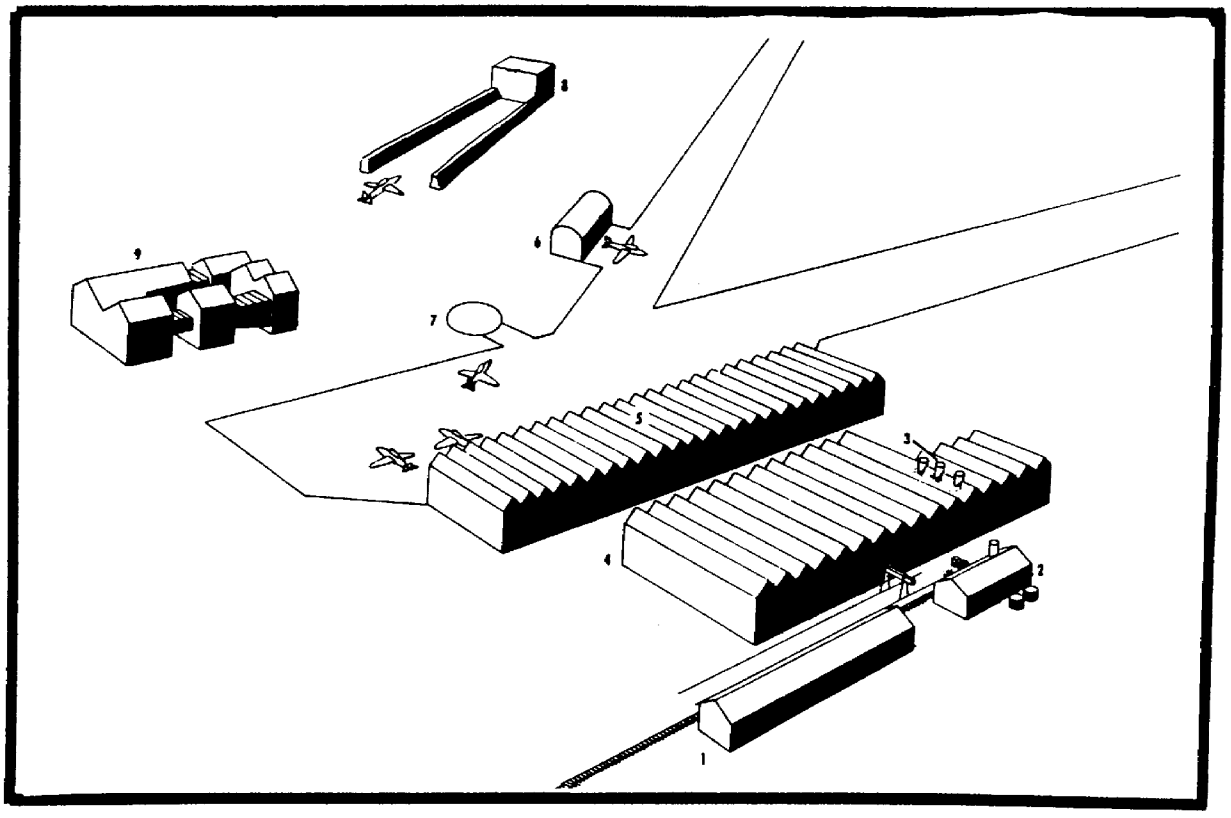


Figure 1-33. Aircraft Assembly Plant.

(7) Annotation 7 shows a compass rose. This calibrated, circular pad is used for testing and calibrating aircraft compasses.

(8) Annotation 8 shows a bore sighting range for armament testing. Some plants use a simple sand mound into which the guns are fired. You find these facilities at plants that manufacture military aircraft. Oil and exhaust stains are normally evident.

(9) Annotation 9 indicates a wind tunnel test facility, which is used primarily during the design phase of aircraft production. Some wind tunnels are built to accommodate actual aircraft; others accept on y scale models of aircraft being designed.

(10) Several other buildings and facilities in and around aircraft assembly plants include:

- o Security fences and guard post
- o Administrative buildings
- o Engineering buildings (usually near subassembly and final assembly buildings)
- o Boiler houses
- o Power plants.

c. The components and production flow of an aircraft assembly plant are very similar to those of an aircraft engine assembly plant. Follow Figure 1-34 while studying the production flow of aircraft engine assembly plant.

(1) The receiving and storage area (Annotation 1) in an aircraft engine plant is usually more extensive than in an aircraft plant. You also find more warehouses and outside storage yards.

(2) The fact more parts are cast and forged for engines than for aircraft makes it necessary for aircraft-engine plants to have larger foundries and forges (Annotations 2 and 3). You often find several foundries and forges relatively near the machine shop areas.

(3) Since the many parts of an engine are machined to precision sizes, the aircraft engine plant has an extensive machine shop area (Annotation 5). These shops are often in separate, well lighted buildings near the subassembly and final assembly areas.

(4) Subassembly and final assembly operations (Annotation 6) can me conducted in one building or in separate buildings. Regardless of the arrangement, final assembly is relatively near the engine test cells (Annotation 7).

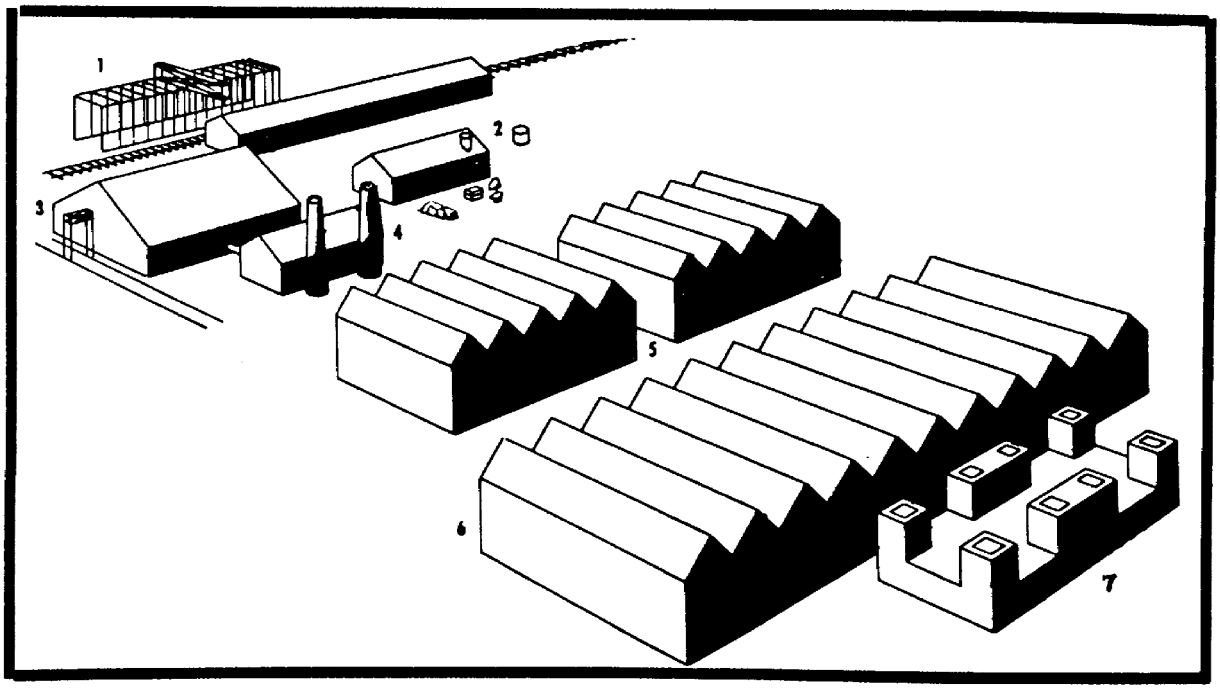


Figure 1-34. Aircraft Engine Assembly Plant.

NOTE: The engine test cells are your key identification clues. Figure 1-34 illustrates the three basic types of engine test cells you normally find. The "U" and the "L" types are used for testing reciprocating or jet engines.

(5) Other facilities which you find in and around aircraft-engine plants include:

- Security fences and guard posts
- Administrative and engineering buildings
- Boiler houses or power plants
- Possibly runways and aircraft.

d. Components are made in various plants ranging in size from a single lathe in a dwelling to the largest of industrial establishments. Pumps, carburetors, electrical equipment, and landing gear instruments are standard components. Wings and fuselages are sometimes built in component plants and shipped short distances for assembly.

(1) Almost any industrial establishment with the probable exception of raw materials processing plants and heavy industries can be used to make components. Textile mills are most conveniently converted.

(2) Propeller blades are made from forgings which are heated, machined, and ground to highly exact surfaces. Propeller hubs are made in a separate assembly line of forged and milled parts which are carefully machined. The two assembly lines, for propeller blade and hub, are usually housed under one root.

(3) Jet-propulsion (gas turbojet) engines require roughly the same kind of operations in their manufacture as do gasoline reciprocating engines. Total of work per engine and number or operations are greatly reduced. Sheet metal working assumes a markedly large role. Jet-propulsion engine production can be carried on in any space or spaces large enough to hold simple machine tools. Any machine Shop or assembly type building can handle all production except the forge and foundry work. A great percentage of the work can be done at dispersed locations. Testing of jet engines is necessary. American engines undergo a testing period which is longer than the total operational life of some foreign models.

(4) Engine-test cells resemble those for reciprocating engines. The walls around the chamber holding the engine will be exceptionally heavy to contain engines which go to pieces under excessive centrifugal force. The air-gas exhaust sets up pulsations of air pressure which are devastating to normal test cells and require heavily constructed exhaust stacks.

NOTE: If noise abatement is a consideration, mufflers of some sort must be installed. These mufflers may occur as bafflers in a normal-appearing U or L air exhaust or as some mechanism resembling a large maximum silencer.

e. The processes used in missile manufacturing are generally the same as those involved in aircraft production, and it is not uncommon to have Doth manufactured under the same root.

(1) Missiles are constructed in the horizontal position so they require less overhead clearance than do aircraft. The height of the building will vary from plant to plant depending on the size of the missile manufactured; however, it will definitely be taller than surrounding structures.

(2) A missile systems test tower is associated with missile air frame manufacture. Ballistic missiles are placed inside such towers in the vertical position through a set of tall, narrow doors and then subjected to tests and checks.

(3) Special transport equipment, such as very long, low-bed trailers (missile transporters), exceptionally long railroad flatcars, and very large cargo aircraft are also associated with missile manufacture.

f. Major recognition features of aircraft and missile plants include:

(1) Receiving and storage area:

(a) Road, rail, and/or water service

(b) Possibly incorporated with main assembly building

(c) Possible open storage with traveling bridge cranes.

NOTE: If warehouses are used, they will appear as long, single-story, lightly constructed buildings.

(2) Pattern shop:

NOTE: Small building identified by a sawdust catcher (a bin) on the side or on the roof.

(3) Foundry:

(a) Usually has substation for electric furnaces or furnace tacks and a fuel supply

(b) Small, single-story separate building

(c) Monitor roofs or other lighting/ventilating features

(d) Surrounded by castings, old molds, and scrap metal

(e) Sandpile may be visible if sand casting molds are used.

(4) Forges:

(a) Resembles a foundry

(b) May be combined under the same roof as the foundry

(c) Will have a boiler house or generator house.

(5) Machine Shop:

(a) Near foundry and storage area

(b) Sawtooth or monitor roofs

(c) Various roof vents with heat and paint stains.

(6) Subassembly:

(a) Between machine shop and final assembly

(b) May be separate building.

(7) Final assembly;

(a) Tallest structure in plant

(b) Hangar-like doors open out onto aircraft parking apron

(c) Access to airfield

(d) Finished aircraft present.

NOTE: Aircraft plants are always located near an airfield.

g. Special missile manufacturing recognition features include:

(1) No special requirement for airfield facilities

(2) No requirement for high overhead clearance as in aircraft final assembly

(3) Rectangular missile systems test tower, located near assembly building, will be taller than all other structures

(4) Missile transporters or long railroad flatcars.

h. Figure 1-35 is an aircraft assembly plant. The large numbers of identical aircraft parked at the edge of the fly-away field identify this plant. The building is large enough so that large aircraft can be assembled.

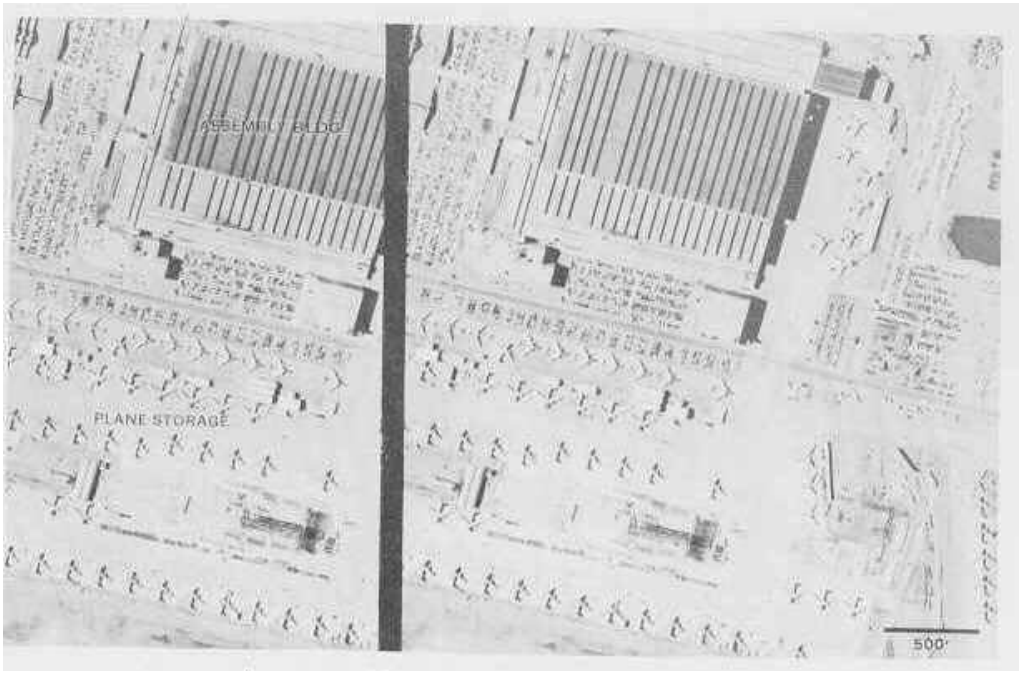


Figure 1-35. Aircraft Assembly Plant.

i. Figure 1-36 is an aircraft engine assembly plant. Aircraft engines from the final assembly section are tested by running them in special units or cells. in these U-type cells the air enters one of the short vent-like openings, passes down and over the engine to cool it and is exhausted through the opposite side along with fumes and heat from the engine.

Figure 1-36. Test Cells and Fabrication Building
in an Aircraft Engine Assembly Plant.

3. Ammunition and Small Arms Plants.

a. Location. Plants are rail served, and located near a large labor pool.

b. Buildings and equipment. There are no characteristic features which, from a distance, enable an observer to distinguish an ammunition and armament plant from an ordinary machinery or engineering plant. The principal buildings, mostly two and three stories, are constructed of brick and reinforced concrete with structural steel roof supports using flat, arch, or gable-type skylights. One or several large smokestacks can be seen from a distance. Revetments and blast walls may surround a production and storage facility for heavy caliber ammunition. The plants normally consist of an integrated complex of weapons forging and foundry facilities, heat treatment and machine shops, and final assembly and finishing shops. A major caliber gun plant would have an extremely tall tower or building section where large gun barrels are lifted from a treating pit. This building section could be 150 feet tall.

c. Input materials. Materials consist of ingot steel, forged steel rods, and perhaps steel gun blanks. Carriages and mounts for artillery pieces may be shipped in.

d. Products. Completely assembled weapons may leave by rail or truck; field artillery pieces may be towed. Small arms and ammunition are shipped in boxes of various sizes.

4. Explosive Manufacturing Plants.

a. Location. Plants and storage are normally located away from built-up areas. If located near a built-up area, they will be surrounded by a cleared belt of land.

b. Buildings and equipment (Figures 1-37 thru 1-40).

(1) Storage facilities usually are of prestressed concrete or cinder block construction (sometimes partially underground), protected by revetments and well dispersed. Boundaries are defined by double fences, walls, and guard towers.

(2) Smokeless powder plants require an extensive area because of the large number of buildings needed. Distance between buildings is necessary to prevent spreading of an explosion or fire. When sufficient area is not available. individual buildings are protected by mounds or barricades.

(3) The majority of the small buildings are of light construction linked by covered walk-ways and most are surrounded or partially shielded by revetments or blast walls. In the case of a smokeless powder blending tower, safety chutes serves an important recognition feature.

(4) Usually nitric acid is manufactured or concentrated in the powder plants. The most important military high explosive is Trinitrotoluene (TNT). Important indicators are reddish brown smoke from the nitric acid production building; the nitric acid concentration building and the three nitration buildings in the TNT area. Safety chutes permit rapid evacuation of buildings in case of emergency. The waste from TNT processing is a yellow, dirty liquid, smelling strongly of caustic.

c. Input materials. Materials consist mostly of chemicals. These are received in tank cars, drums, other closed containers or closed railcars.

d. Products will not be visible in most cases. They are shipped by truck or rail and the carrier will be labeled as containing explosives. Rail shipments consist of only a few cars at a time.

e. Tetryl, the sensitive explosive used as booster, is produced in small, widely spaced buildings (Figure 1-37). Escape chutes are seen at the nitrating and refining buildings. After being nitrated, the tetryl is refined before being packed and shipped.

NOTE: Each production line operates independently.

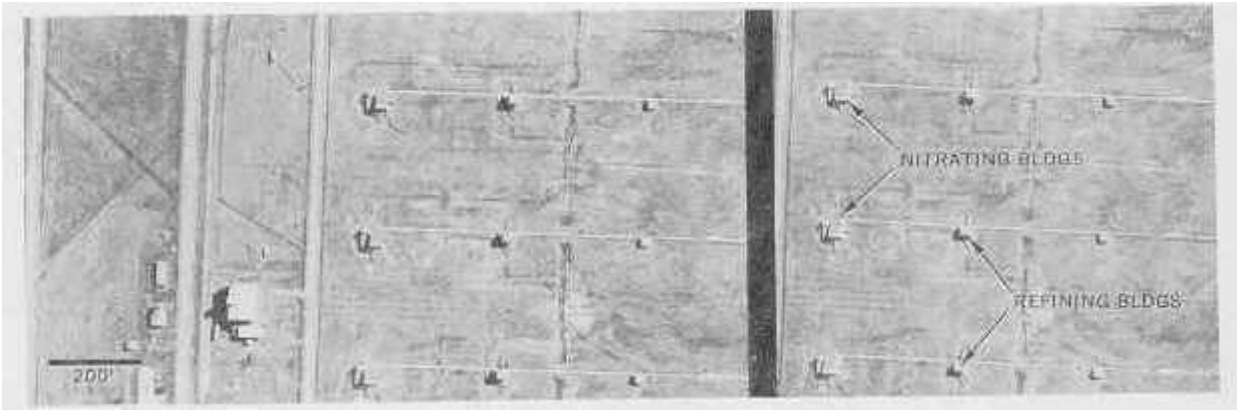


Figure 1-37. Tetryl Production.

f. Interior blast walls extend above the root level of these buildings where explosive materials such as powder is pressed or melted. In the event of an explosion, the blast is directed upward and is confined (Figure 1-38).

Figure 1-38. Explosive Production Buildings with Blast Walls.

g. Explosive powder is placed in bins and air from blowers is forced through the powder for drying. These final drying buildings are protected by blast walls (Figure 1-39).

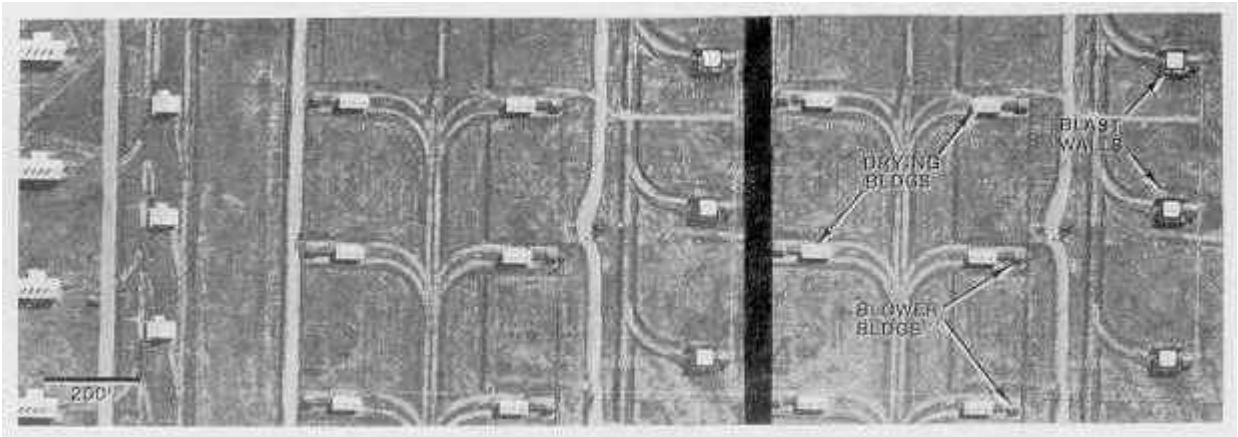


Figure 1-39. Drying and Block Buildings.

h. Nitroglycerine and dynamite production are shown in Figure 1-40, buildings at far eastern plants are closely grouped and heavily revetted. Nitroglycerine is produced here and used usually to manufacture dynamite.

Figure 1-40. Nitroglycerine and Dynamite Production Buildings.

5. Motor Vehicle Production Plants.

a. Location. Plants are rail served and most of the older facilities are located in large urban areas. Newer plants are located in rural areas.

b. Buildings and equipment. Very large plants may be fully integrated, including open hearth steel. Others may be concerned primarily with final assembly of vehicles or with the production of one or more major components, such as engines, bodies, and transmission. Buildings can be either single- or multistoried. Additionally, they may include one or more of the following features:

(1) Fast-track for motor vehicles.

(2) Parking lot for vehicles awaiting shipment.

(3) Plant and/or building within the plant area may be isolated due to constant sound of engine testing.

(4) Foundry root is generally a monitor-type and has several short stacks.

(5) Forge root is possibly a monitor-type with at least one short stack.

(6) Large assembly building of brick or sheet metal construction, with high, clear span and possibly a sawtooth root.

(7) Machine shoos of brick or steel metal construction, a heating or power plant, and service buildings.

c. Input materials. Major input items are steel billets, sheet steel, glass, rubber tires, petroleum products, and upholstery materials. Depending on the degree of integration, the plant may receive engines, bodies, or other components in large quantities.

d. End products. The output consists of finished automobiles. trucks, buses, tractors, trailers, armored personnel carriers, prime movers, and specialized vehicles, such as fire fighting and ambulance. It the plant is concerned with the production of components, it may produce engines, chassis, drive shafts, radiators, and electrical components.

e. In Figure 1-41, an automobile assembly plant is shown. The small auto parts to be used in the adjacent building are stored in the open and handled by small forklift trucks. Storage yards at light fabrication industries are rarely served by overhead cranes.

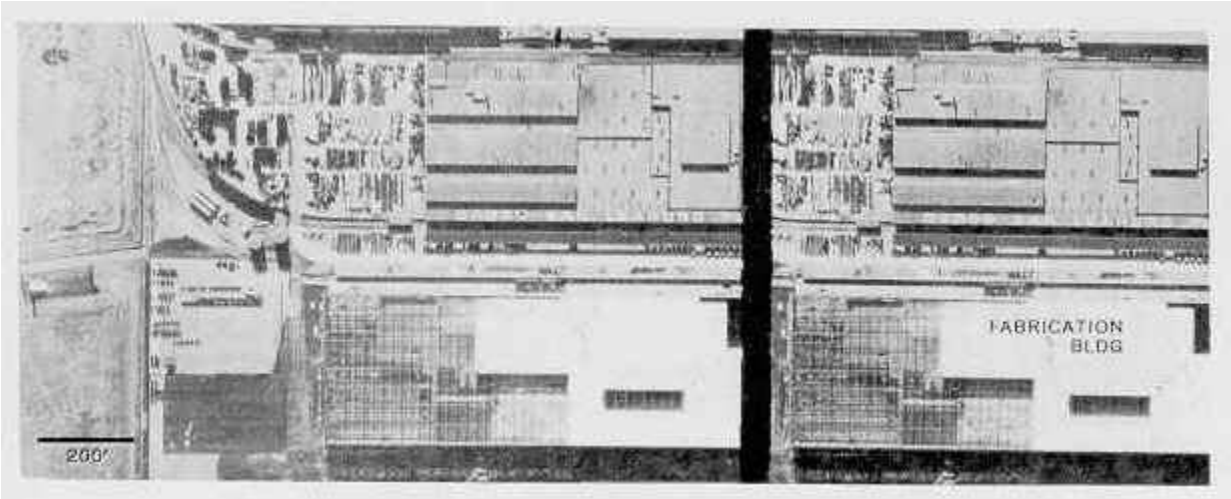


Figure 1-41. Automobile Assembly Plant.

f. Trucks assembled in the adjacent buildings are stored in the open until final delivery (Figure 1-42).

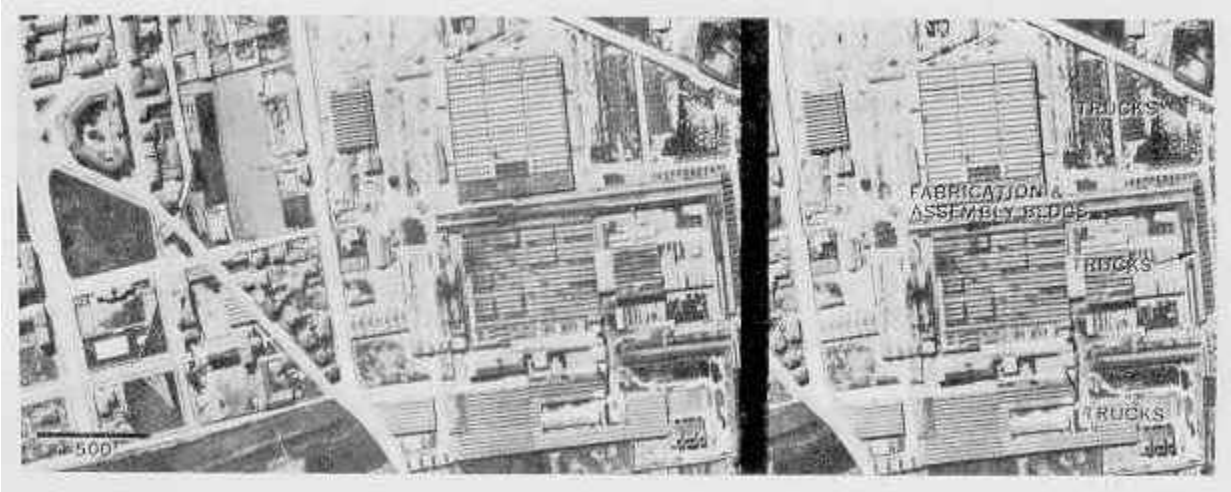


Figure 1-42. Open Storage of Trucks.

6. Boat building and repair industries are similar to snip building except the equipment is more complex.

a. Boat yards producing similar craft, both maritime and inland, can be located on any protected waterfront.

b. Some of these yards build small, high speed, naval craft which carry and launch short range missiles.

c. Marine railways (Figure 1-43). boats to be repaired are cradled on inclined rails which extend into the water. A winch at the head of the railway raises and lowers the cradle on which the boat is held.

Figure 1-43. Marine Railways.

d. Transverse building ways and side launching ways are depicted in Figure 1-44. Barges assembled on cradles in the building ways are hauled onto the launching way. The craft are then lowered sideways into the receiver by cables controlled from winch houses at the head of the launching way.

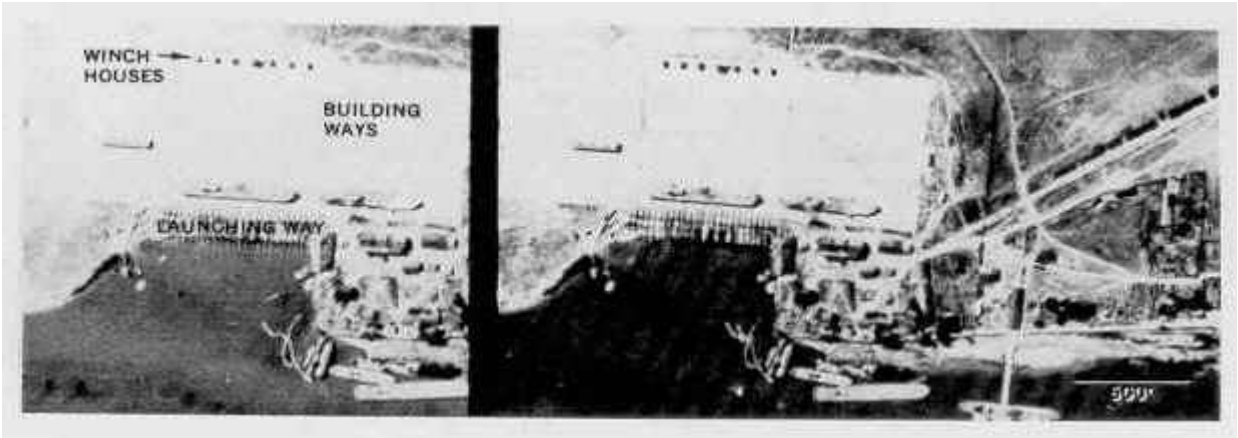


Figure 1-44. Building Ways and Launching Way.

7. Meat packing and fish canning are also in the light fabrication industries category.

a. The large multistory, multisectional building in Figure 1-45 houses the slaughtering, processing, and storage sections of the plant. A ramp is used to bring the livestock to the slaughtering section. The rest of the building is used for such meat processing as smoking and canning.

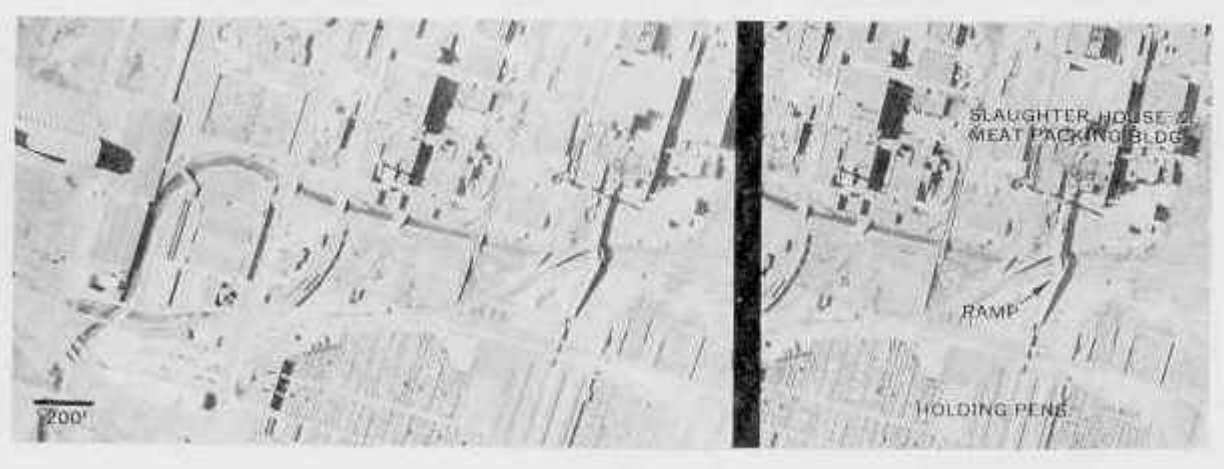


Figure 1-45. Meat Packing Plant.

b. At this fish canning industry (Figure 1-46), fish are transferred from small fishing boats onto conveyors. The conveyers carry the fish to the upper level of the cannery buildings. The fish are canned, oil is rendered from the scraps and stored in tanks, and fish meal is prepared and sent to warehouses. Furthermore, fish net drying racks are associated with this industry. Fish nets are spread over open framework to dry.

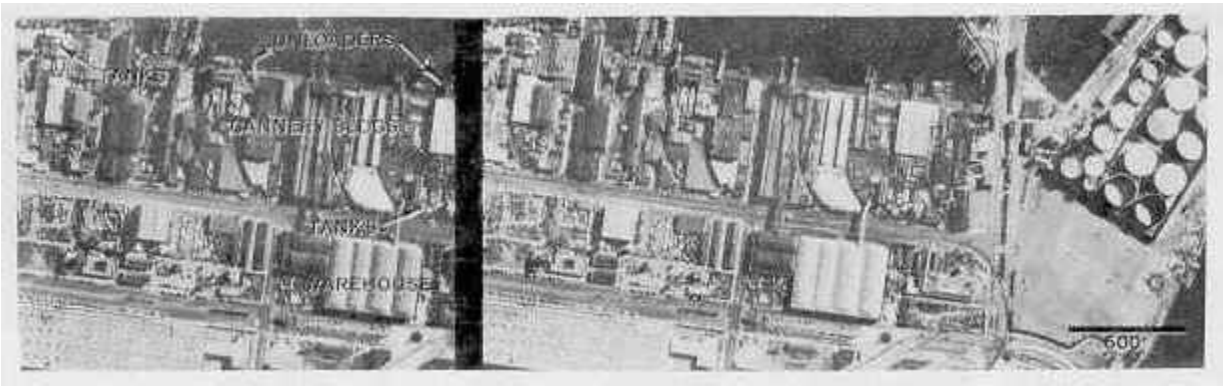


Figure 1-46. Fish Cannery.

8. Fertilizer mixing and food processing are also light fabrication industries.

a. Fertilizer mixing plants will have conveyors, medium size mixing buildings with vents, and storage buildings (Figure 1-47).

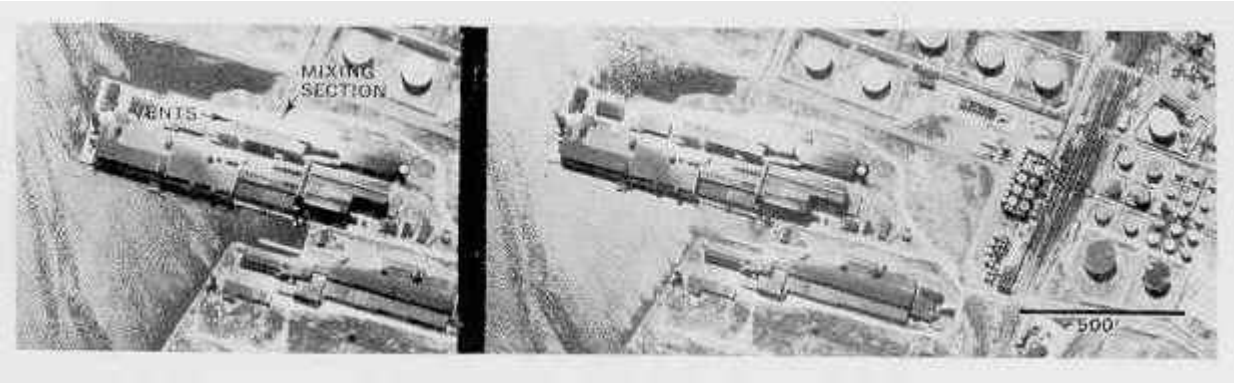


Figure 1-47. Fertilizer Mixing.

b. Figure 1-48 shows oils extracted from vegetable sources in the adjacent multistory buildings being stored in closely grouped tanks. These oils are then further refined, packaged, and shipped. The oils will be used for human consumption, to make soap and as a source of glycerin.

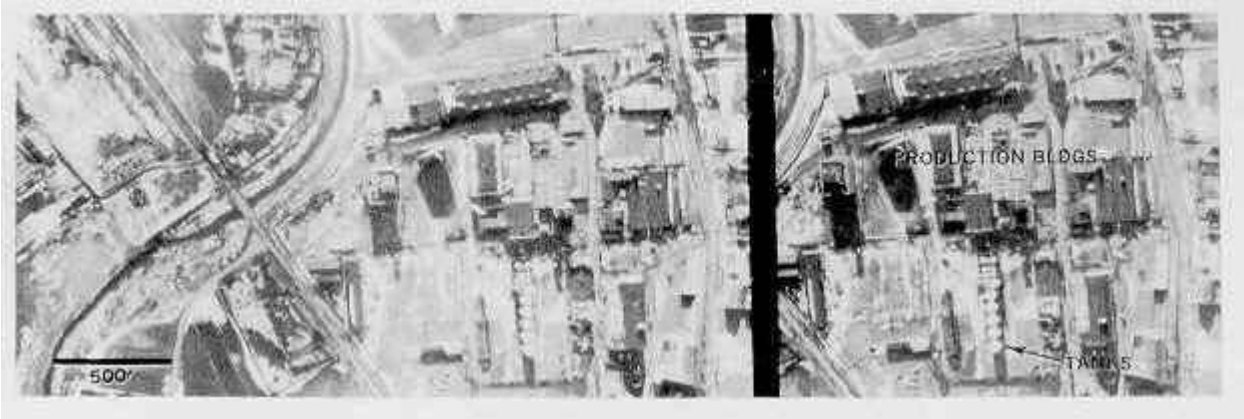


Figure 1-48. Vegetable Oil Fabrication.

LESSON

PRACTICE EXERCISE

The following items will test your grasp of the material covered in this lesson. There is only one correct answer to each item. When you nave completed the exercise, check your answers with the answer key that follows. If you answer any item incorrectly, study again that part of the lesson which contains the portion involved.

1. Which image component is the most obvious and abundant in fabrication industries?

   A. Cranes.

   B. Buildings.

   C. Open storage.

   D. Rail lines.

2. What are two types of fabrication industries?

   A. Heavy and processing.

   B. Extraction and light.

   C. Heavy and light.

   D. Processing and electric.

3. What subcategory does farm equipment fail under?

   A. Heavy fabrication.

   B. Machinery plant.

   C. Motor vehicles.

   D. Light fabrication.

4. Which of the following is a major recognition feature of a light fabrication industry?

   A. Light steel or wood framed buildings.

   B. Heavy steel framed, single-story buildings.

   C. Little or no waste.

   D. Rail lines entering buildings.

Refer to Figure 1-49 for questions 5 and 6.

5. What identification feature is at Annotation A?

   A. Launching ways.

   B. DrydocK.

   C. Graving dock.

   D. Transverses.

6. What is the industry?

   A. Machine plant.

   B. Cannery.

   C. Boat yard.

   D. Ship repair yard.

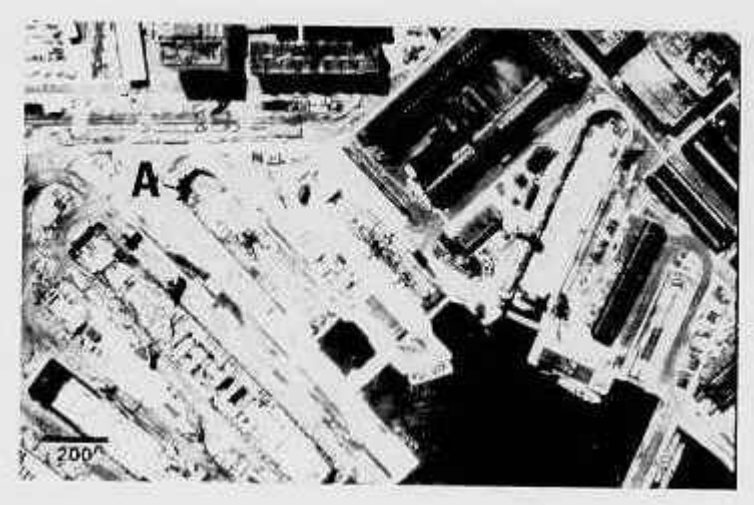


Figure 1-49.

Refer to Figure 1-50 for questions 7 and 8.

7. What type of fabrication building is at Annotation A?

   A. Assembly building.

   B. Slaughter house.

   C. Foundry.

   D. Boiler house.

8. What type of light fabrication industry is this?

   A. Fish cannery.

   B. Food processing.

   C. Meat packing plant.

   D. Textile industry.

Figure 1-50.

LESSON

PRACTICE EXERCISE

ANSWER KEY AND FEEDBACK

ITEM	CORRECT ANSWER AND FEEDBACK
1.	B. The most obvious and abundant image component in fabrication industries is buildings (page 2, para 2a).
2.	C. The two types of fabrication industries are heavy and light (page 4, fig 1-2).
3.	D. Farm equipment falls under the subcategory of light fabrication industry (page 12, fig 1-16).
4.	A. Light steel or wood framed buildings is a major recognition feature of heavy fabrication industries (page 31, para 1).
5.	C. The identification feature at Annotation A is a graving dock (page 22, fig 1-23).
6.	D. The industry in Figure 49 is a snip repair yard (page 22, fig 1-23).
7.	B. A slaughter house i the fabrication building in Annotation A (page 46, fig 1-45).
8.	C. The industry is a meat packing plant (page 46, fig 1-45).